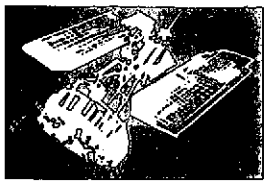
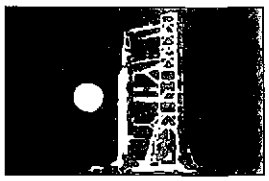
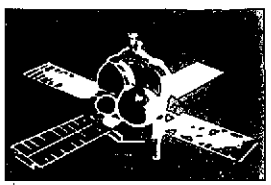
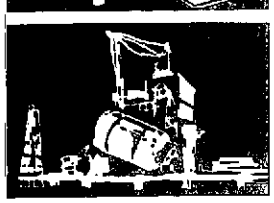
2 mw

SPACE DIVISION



73SD4260
10 August 1973

ERTS 1 FLIGHT EVALUATION REPORT
23 APRIL 1973 TO 23 JULY 1973

Prepared By
GE ERTS OPERATIONS CONTROL CENTER

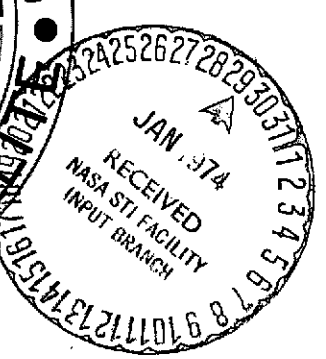
For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

(NASA-CR-136617) ERTS-1 FLIGHT EVALUATION REPORT, 23 APRIL - 23 JULY 1973 (General Electric Co.) ~~205~~ 186 p HC $12.25 CSCL 05B

N74-15073

Unclas
G3/13 27575



Contract NAS5-21808

GENERAL ELECTRIC

73SD4260
10 AUGUST 1973

ERTS 1 FLIGHT EVALUATION REPORT
23 APRIL 1973 TO 23 JULY 1973

Prepared By
GE ERTS OPERATIONS CONTROL CENTER

For
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

Contract NAS5-21808

APPROVED: Thomas W. Winchester
Thomas W. Winchester

SPACE DIVISION
Valley Forge Space Center
P. O. Box 8555 • Philadelphia, Penna. 19101

GENERAL ELECTRIC

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONT'D)

LIST OF TABLES

LIST OF TABLES (CONT)

INTRODUCTION

This is the fifth in a series of documents issued periodically to present flight performance analysis of the ERTS-1 Spacecraft. Previously issued documents are:

Doc. ID	Title	Date
72SD4255	ERTS-1 Launch and Flight Activation Evaluation Report	18 October 1972
72SD4262	ERTS-1 Flight Evaluation Report 23 July 1972 to 23 October 1972	28 November 1972
72SD4224	ERTS-1 Flight Evaluation Report 23 October 1972 to 23 January 1973	27 February 1973
73SD4249	ERTS-1 Flight Evaluation Report 23 January 1973 to 23 April 1973	29 May 1973

This report contains analyses of performance for the fourth three months of operation, i. e., Orbit 3810 to 5100.

Documents, reports and listings related to this report are contained in the following Appendixes.

Appendix	Contents
A	Evaluation Related Documents Issued During this Reporting Period
B	A List of all Anomalies Observed Since Launch
C	DCS Subsystem Performance (PIR 1T23-ERTS-97)
D	Telemetry Matrix Location Table
E	ERTS-1 Ground Trace Repeat Cycle Prediction Table (Contains Spacecraft Orbit/Day Relationship)

Future ERTS-1 reports are scheduled on a quarterly basis.

SECTION 1

SUMMARY

SECTION 1

SUMMARY - ORBITS 3810-5100

The ERTS-1 spacecraft was launched from the Western Test Range on 23 July 1972 at 18:06:06.508Z. The launch and orbital injection phase of the space flight were nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147 after which a power transient disabled one of the Wideband Video Tape Recorders (WBVTR-2). Operations resumed until Orbit 196 when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands and since that time ERTS-1 has performed its mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. In Orbit 3463 abnormally high minor frame sync error counts were seen on the WBVTR-1 data, but operations continue on restricted sections of the tape and the error counts have greatly diminished.

ORBITAL PARAMETERS

The launch and injection of ERTS-1 required some correction at Orbit 44 and 59 to achieve the desired 18-day repeat cycle. During Orbit 938 it was necessary to execute a 12.8 second burn and in Orbit 2416 a 20.4 second burn of the -X thruster to maintain the ground trace in the desired 18-day repeat pattern of ± 10 miles. The ground trace was within the allowable band throughout this report period. No adjustment of orbit parameters has been made since Orbit 2416 noted above.

POWER SUBSYSTEM

The power subsystem performed well throughout this report period. Solar array current has been as predicted. Data from this period shows the array degradation to be -14.42% after one year in orbit. The power subsystem will meet ERTS-1 power requirements through 1975 with the present payload configuration. Battery temperature spread remained low and performance of each battery remained good.

ATTITUDE CONTROL SUBSYSTEM

From the initial acquisition, the ACS performance has been excellent. All functions are active and well within specifications. Perturbations due to sun glint in the IR horizon scanners are not disruptive enough to necessitate single scanner mode. The magnetic moment compensating assembly corrected the +Roll gating to permit flywheel unloading during darkness when payloads are disabled. Gating frequency decreased during this period and only 14 percent of the impulse available at launch has been used.

COMMAND/CLOCK SUBSYSTEM

All stored commands have executed and all real time commands except the expected one in approximately 10, 000 associated with the logic race in the design. No serious problems have resulted from these few commands failing to execute. A minor anomaly has occurred in loading COMSTOR B; cell 12 which on twenty-three occasions verified with a delta of 256 seconds change to the desired execute time. Each time, a second try verified correctly. No explanation has yet been found for this condition. Use of this cell for active commands has been discontinued.

TELEMETRY SUBSYSTEM

The telemetry subsystem has consistently performed in an excellent manner except as noted below. Memory Section 0, 0 has been in use since launch and no alternates have been required. All dropouts have been associated with known link or ground problems. In Orbit 4396 an integrated circuit chip in the TMP failed disabling four telemetry channels. Spacecraft operation was not affected.

ORBIT ADJUST SUBSYSTEM

The orbit adjustment subsystem has been fired five times, all from the -X thruster. The four second burn gave 60 percent of computed thrust but longer burns gave very near computed thrust. Three firings were for initial correction, two for orbit maintenance. No orbit adjustment activity was executed in this report period.

MAGNETIC MOMENT COMPENSATING ASSEMBLY

The Magnetic Moment Compensating Assembly has been operated five times and performance has been reasonably close to nominal. The hysteresis loop associated with the MMCA requires trial and error after the first charge and dump. The attained performance of the unit is considered excellent. It has held the Pole-Cm values commanded in earlier orbits. There was no activity in this subsystem during this report period.

UNIFIED 'S' BAND PRE-MODULATOR PROCESSOR

The Unified 'S' Band Receiver A, Transmitter A, and Premodulation Processor have continued to operate satisfactorily since separation in Orbit Zero. The transmitter power output declined in ten steps from 1.6 watts at launch to 0.29 watts in Orbit 3574. Since then, the power has remained stable through Orbit 5100, adequate to perform all its functions satisfactorily. The redundant "B" section of the USB has not yet been used.

ELECTRICAL INTERFACE SUBSYSTEM

The Auxiliary Processing Unit (APU), Interface Switching Module (ISM) and Power Switching Module (PSM) performed normally in this report period. The RBV switching relay (within the PSM) failed on Orbit 196 and has not been in use.

THERMAL CONTROL SUBSYSTEM

The thermal subsystem performed normally throughout this report period. Temperatures decreased slightly due to decreasing sun intensity but had no noticeable effect on operation.

NARROW BAND TAPE RECORDERS

The Narrowband Tape Recorder Subsystem has continued to operate satisfactorily without incident. Each recorder in turn has operated through its modes of record, playback and off for a total ON time of 4474 hours.

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has continued to operate satisfactorily. The power output has remained at 20 watts since launch. Wideband Power Amplifier Number 2 has been primarily used to transmit the MSS data both in playback and in real time. Wideband Power Amplifier

Number 1, used early with RBV, was used briefly with MSS during the Apollo moon operations, and performed satisfactorily.

ATTITUDE MEASUREMENT SENSOR

The AMS continues to function in all respects. Derived values are being used in image processing and effort is continuing to improve correlation relationship between spacecraft attitude, the ACS and the AMS.

WIDEBAND VIDEO TAPE RECORDERS

Wideband Video Tape Recorder Number 1 has operated satisfactorily without incident in this reporting period for the limited range of tape footage used. After a period of high Minor Frame Sync Error counts and high headwheel current during and after Orbit 3463, both of these parameters returned to normal by Orbit 4650 and has functioned in its pre-anomaly manner since. Tape footages between 1160 and 1830 have been used in this period, but only the approximate last quarter of the 1800-foot tape is currently in use. The third quarter of the tape has been shown to be satisfactory and makes available at least the last half of the tape for future use. The condition of the first half of the tape has not yet been conclusively tested.

RETURN BEAM VIDICON

The Return Beam Vidicon Subsystem has been idle since Orbit 196, when its input power supply switching system malfunctioned. The RBV had operated satisfactorily up to that point, photographing 1690 scenes of good quality. The failure was not in the RBV itself, nor was the RBV affected by the failure.

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem, in the first operational use of this instrument, has operated flawlessly, exceeding expectations. It has averaged 198 scenes a day from every major land mass on earth and has on short notice provided scenes of volcano eruptions in Iceland and Nicaragua, floods in the Mississippi Valley, and drought in Africa. All units of the subsystem appear normal and stable.

DATA COLLECTION SYSTEM

The Data Collection Subsystem continued to operate satisfactorily. No significant interference occurred in this reporting period. The system has demonstrated 99% reliability and a range of 3400 kilometers. Over 400,000 messages were received in its first year's operation.

PAYLOAD OPERATION SUMMARY

Launch through Orbit 5100

Subsystem	Orbital On-Time HH:MM:SS	Operational Summary	
RBV	13:59:09	Total scenes photographed	1690
		Average scenes per day	139
		Total area photographed (square nautical miles)	14.7×10^6
		ON-OFF cycles	91
		% Real Time scenes	57
		% Recorded scenes	43
MSS	685:07:48	Total scenes photographed	70,948
		Average scenes per day	198
		Total area photographed (square nautical miles)	618×10^6
		ON-OFF cycles	5616
		% Real Time scenes	55
		% Recorded scenes	45
DCS	8771:17:50	Messages received at OCC	403,649
		Non perfect messages	32,214
		Ground platforms identified	218
		Max. Ground platforms active/ orbit	105
		Users	34
		Average messages per orbit	152
WBVTR-1	629:14:26	% Record Mode	38
		% Playback Mode	41
		% Rewind Mode	20
		% Standby Mode	1
		Minor Frame Sync, Error Count:	
		Realtime	0
		Playback (to Orbit 3463) (1)	< 10
		Time Video Head - In-Contact (2)	497:03:21
		Cycles of Head - In-Contact	5138
WBVTR-2	9:26:33	% USAGE SAME AS WBVTR-1 FAILED IN ORBIT 148/9	
WPA-1	31:55:09	% Real Time Mode	55
		% Playback Mode	45
		Used in Orbits: 5 thru 196 and 1890 thru 2099	
		ON-OFF cycles	311
WPA-2	575:18:48	% Real Time Mode	55
		% Playback Mode	45
		Used in Orbits: 5 thru 1889 and 2100 thru 5100	
		ON-OFF cycles	4504

(1) After anomaly in Orbit 3463, MSFE count rose to over 80 about Orbit 4150, then subsided to less than 5 after Orbit 4650.

(2) Total Head-In-Contact Time (including 126 hrs pre-launch) is 623:03:21.

SECTION 2

ORBITAL PARAMETERS

SECTION 2

ORBITAL PARAMETERS

The ERTS-1 launch and injection was satisfactory and required only a minor orbit adjust to achieve nominal parameters. These adjustments were made in Orbits 38, 44 and 59. After several 18-day repeat cycles, orbit maintenance burns were made in Orbit 938 and again in Orbit 2416.

The orbital parameters are given in Table 2-1. Figure 2-1 shows the subsatellite plot and Figure 2-2 shows the longitude error as a function of time and orbit maintenance burns. The longitude error has been maintained within the ± ten N.M. average in the east-west direction at the equator as planned. Figure 2-3 is a summary of ERTS-1 orbital periods. A review of the Anomalistic Periods reflect both the effects of the ACS (+) Pitch Gating frequency and of atmospheric drag to produce orbital decay. As shown in Figure 4-2, the (+) Pitch gates increased from ≈4/ day after the MMCA Corrections (Orbit 222) to a maximum of ≈11/ day in January, 1973 (Orbit 2400) with a gradual decrease to ≈0.1/ day in June, 1973 (Orbit 4650). Appendix E gives ground trace repeat cycle predictions.

Table 2-1. Brouwer Mean Orbital Parameters

Element			25 Oct 1972	25 Jan 1973	25 April 1973	25 July 1973
(1)	Apogee	KM	917.3	922.3	911.056	914.341
(2)	Perigee	KM	898.1	893.1	888.763	900.810
(3)	Inclination	deg	99.103	99.090	99.073	99.068
(4)	Semimajor Axis	KM	7,285.850	7,285.865	7,285.767	7,285.741
(5)	Eccentricity	---	0.00132	0.00200	0.00073	0.00093
(6)	Anomalistic Period	min.	103.152	103.153	103.151	103.150
(7)	Nodal Period	min.	103.268	103.268	103.267	103.266
(8)	Argument of Perigee	deg	93.721	133,693	168,857	95.602
(9)	Right Ascension	deg	1.060	91.805	181.411	268.944
(10)	Mean Anomaly	deg	86.484	52.797	11.098	84.301
(11)	Daily % Overlap		14.9	14.7	14.9	15.068

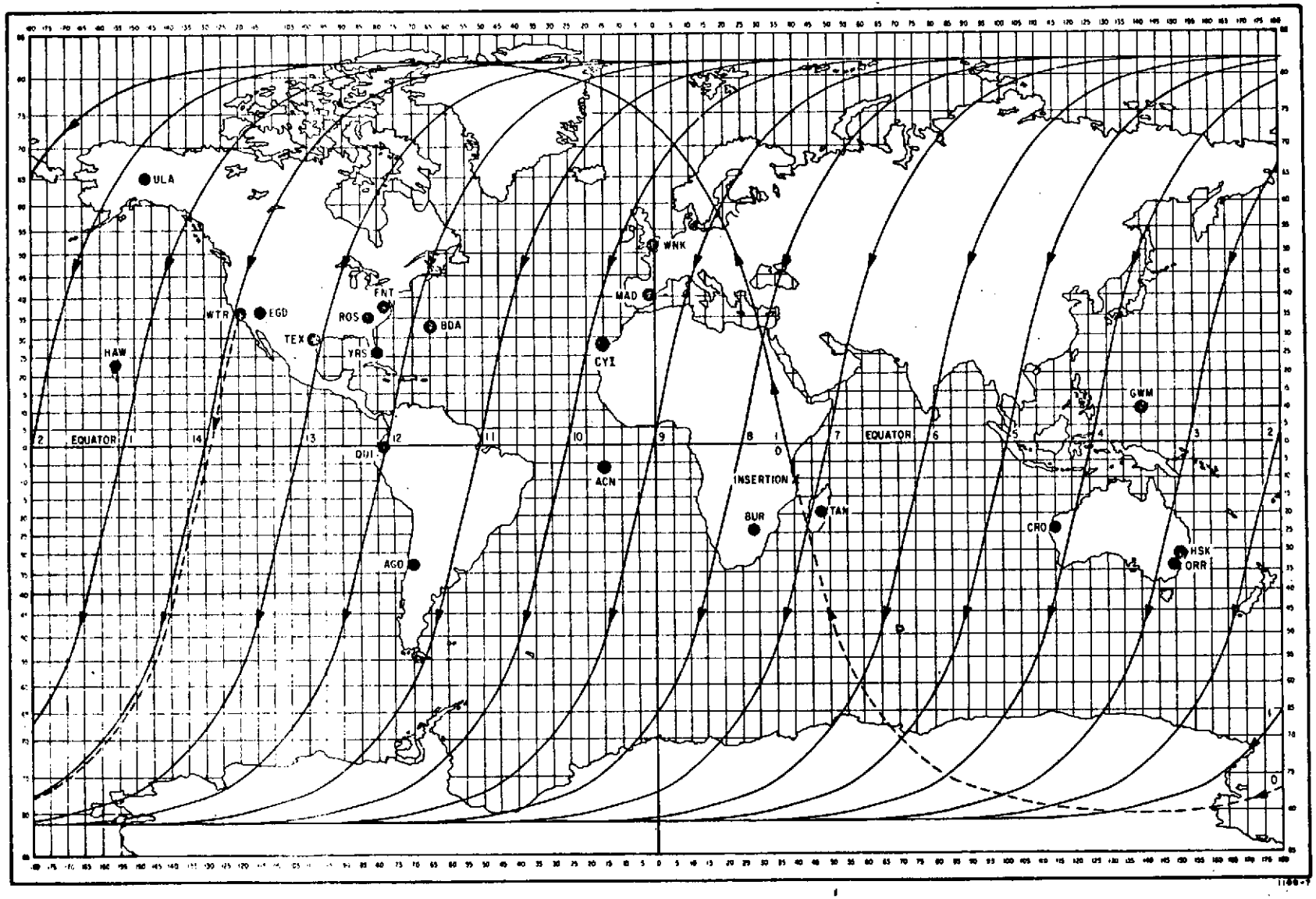


Figure 2-1. Typical Subsatellite Plot of the ERTS-1 Spacecraft

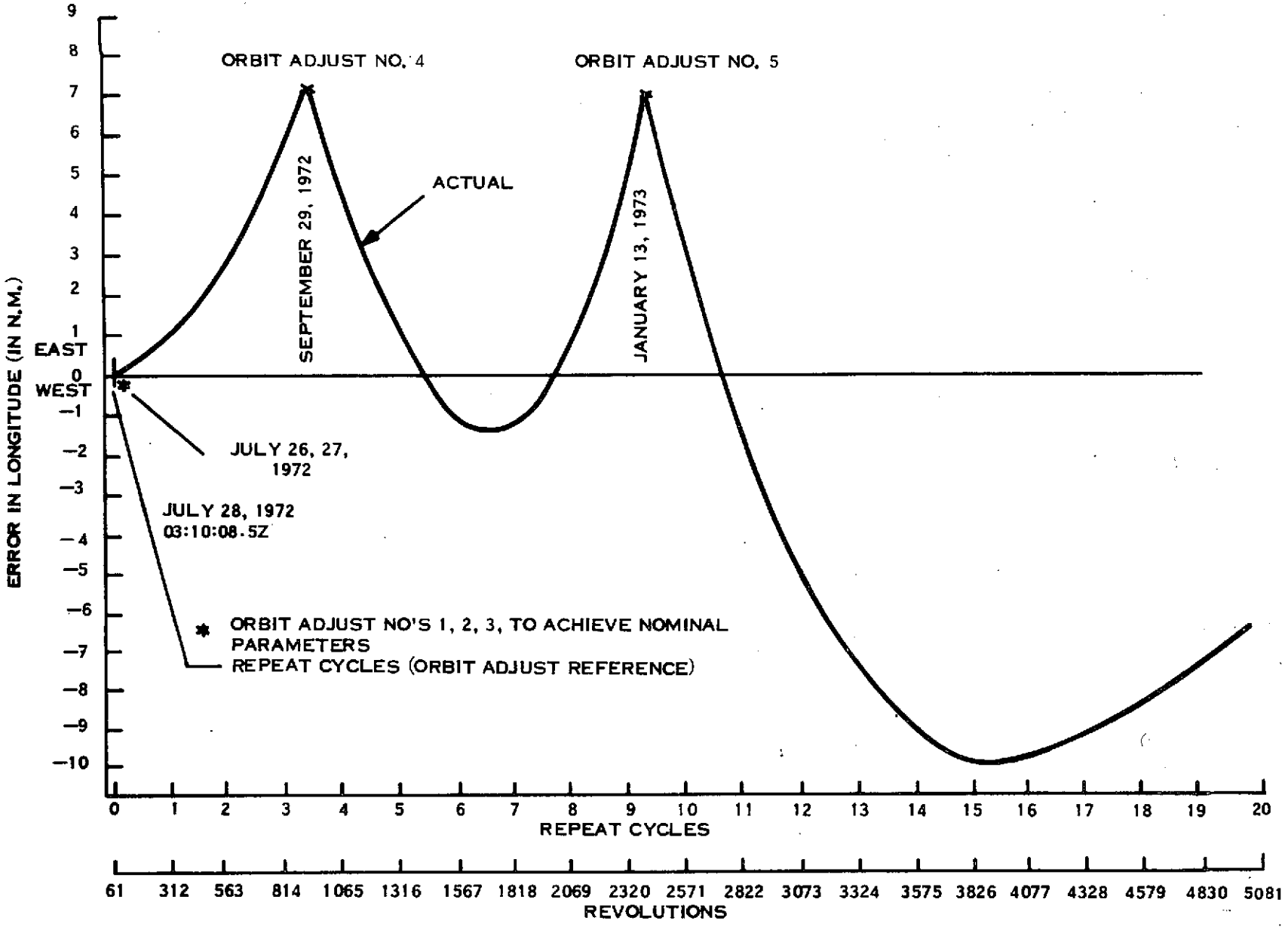


Figure 2-2. Effects of Orbit Adjust on Ground Track

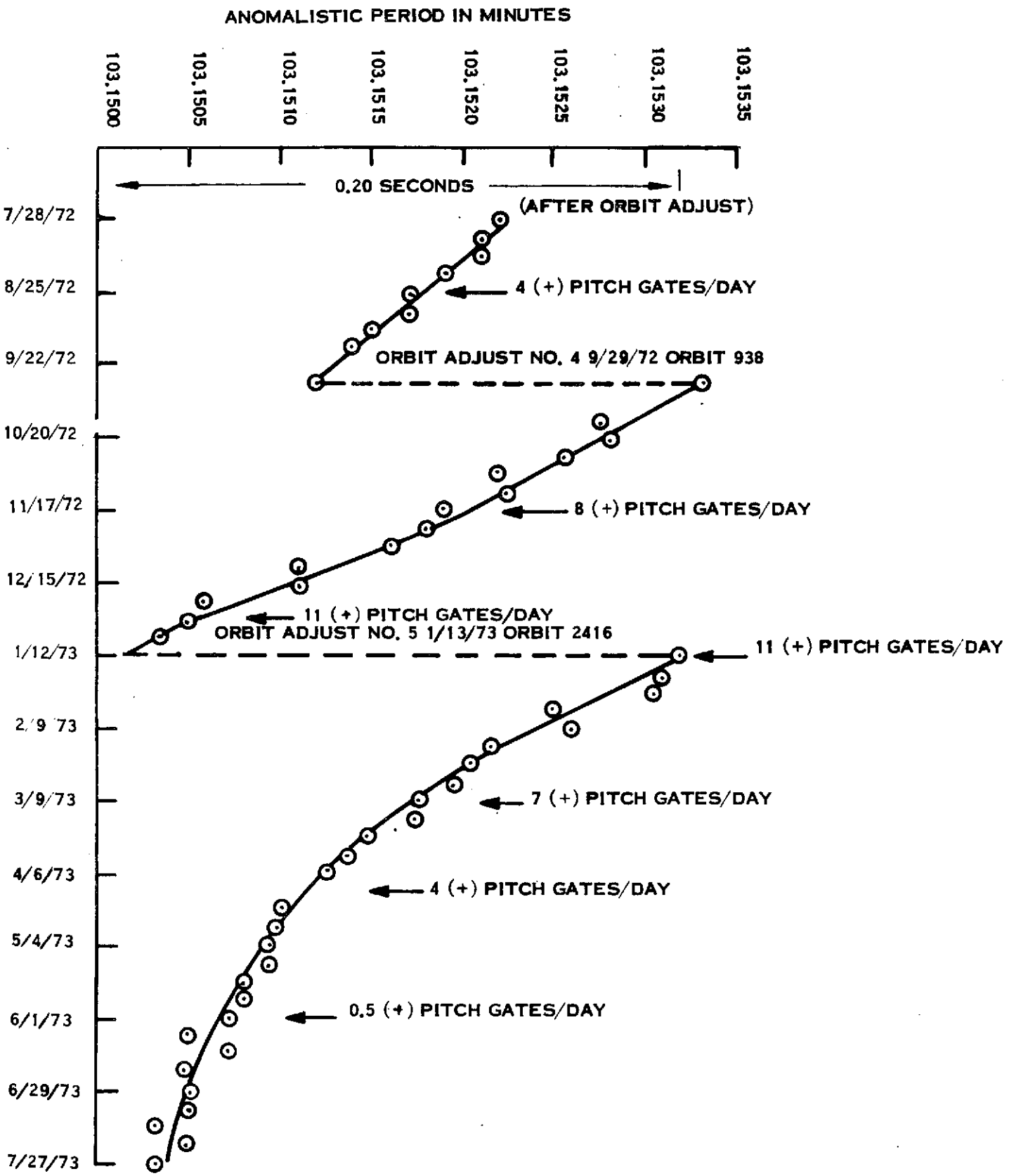


Figure 2-3. ERTS 1 Orbital Period

SECTION 3

POWER SUBSYSTEM (PWR)

SECTION 3

POWER SUBSYSTEM (PWR)

The solar array provided excess energy for the payload and spacecraft load throughout this report period. Compensation loads and auxiliary loads dissipated the excess power above the battery and load requirements using ERTS-1 power management procedures which were automated in early May, 1973. Midday measured solar array current tracked closely to the values predicted in the previous quarter. Solar array degradation was -14.42% at the end of one year in orbit. The power subsystem is predicted to have adequate power through 1975 for the present ERTS-1 payload configuration and may extend to 1976 and 1977 depending on the electro-chemical degradation of the battery packs for that period.

A plot of measured and predicted Midday Solar Current is shown in Figure 3-1. Figure 3-2 shows actual and predicted Solar Array Current Degradation. Figure 3-3 and 3-4 show Solar Paddle Sun Angles and Seasonal Sun Intensity versus calendar days of the year.

In Orbit 4765, while the ERTS-1 spacecraft ground trace was in the Atlantic Ocean just off the coast of North Africa, the spacecraft passed through the penumbra of a total eclipse which was centered in North Africa. The solar array current decreased from 13.2 to 8.5 amperes during the passage through the penumbra as shown on the brush charts displayed as Figure 3-5.

Battery packs ranged from 9.8 to 11.3 percent Depth of Discharge (DOD) with an average of 10.0 over a 24-hour period of normal operation. Temperature spread between batteries decreased to 4.4 degrees C during this report period due to decreasing sun intensity. Charge and load sharing were satisfactory. During Orbit 4396, four telemetry gates mounted on one integrated circuit chip failed (see PIR 1T23-ERTS-93 in Appendix B). Function 6012 Battery 2 charge current began reading erroneously high. In Orbit 4397, Battery 2 was turned off. The battery was established to have been charging and discharging correctly after the telemetry failure so it was turned back on in Orbit 4407 and has been performing well.

The power system electronics performed well in this report period with all voltages stable. Table 3-1 shows Major Power Subsystem Parameters and Table 3-2 shows Power Subsystem Telemetry for selected orbits. Some parameters in Table 3-2 may be slightly different than Table 3-1 because Table 3-1 uses a time span for power management (night followed by a day) different from the time span which is used in Table 3-2 which is the playback period from the NBTR. The Shunt Limiter has not operated since Orbit 3 because the unregulated voltage has been held below cut-in voltage by power management.

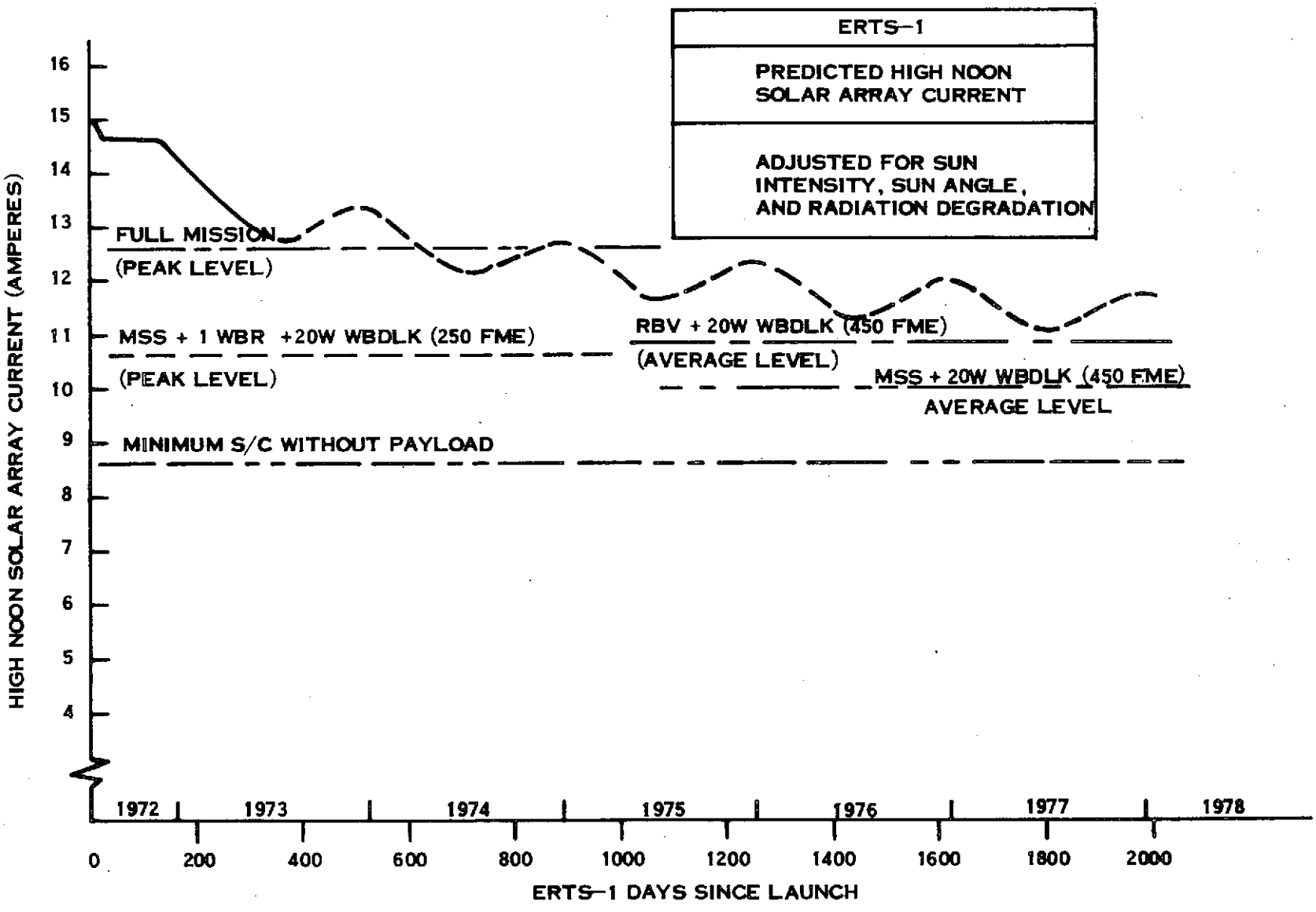


Figure 3-1. Predicted Midday Solar Current

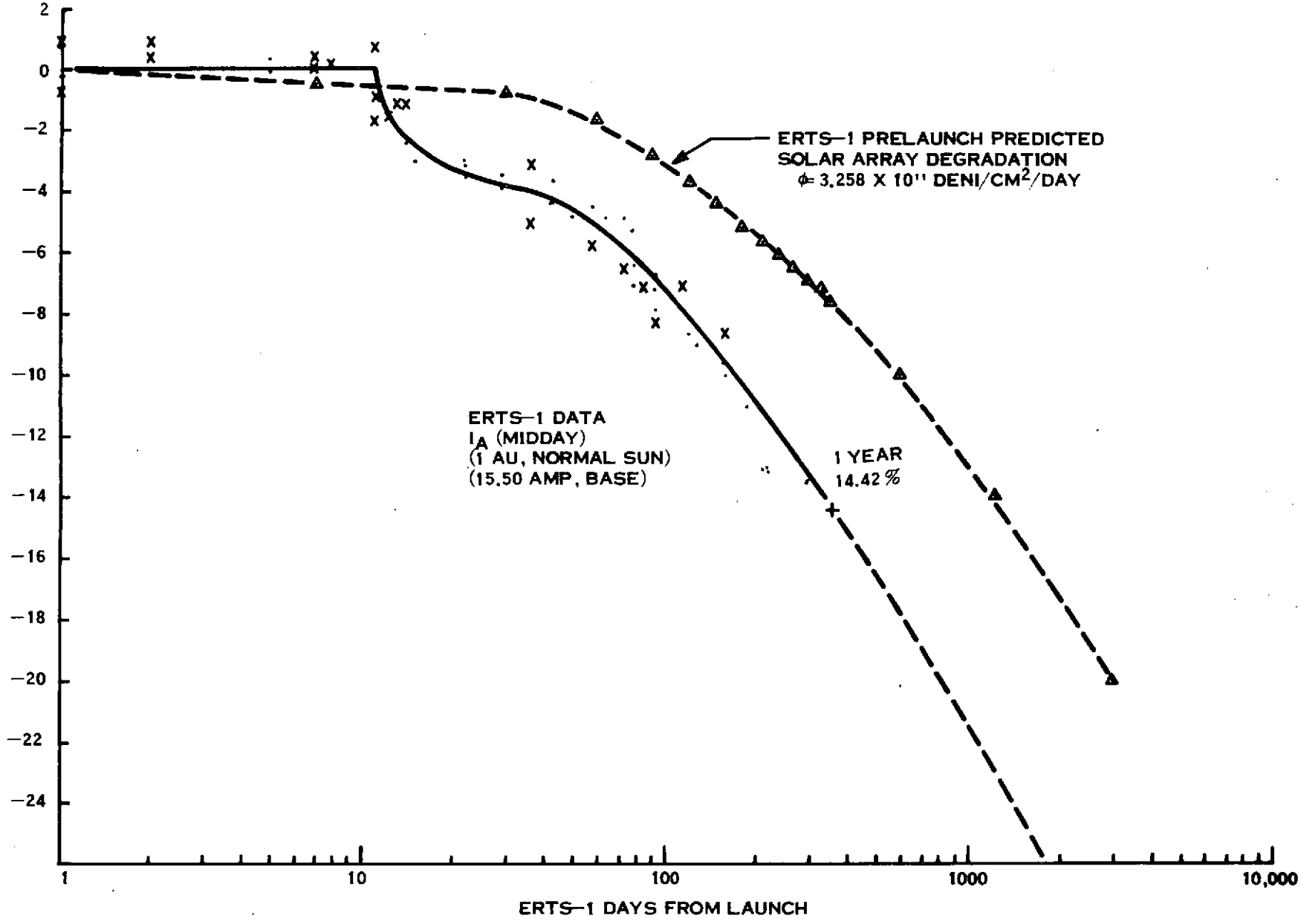


Figure 3-2. IA (Midday) Degradation vs. Days

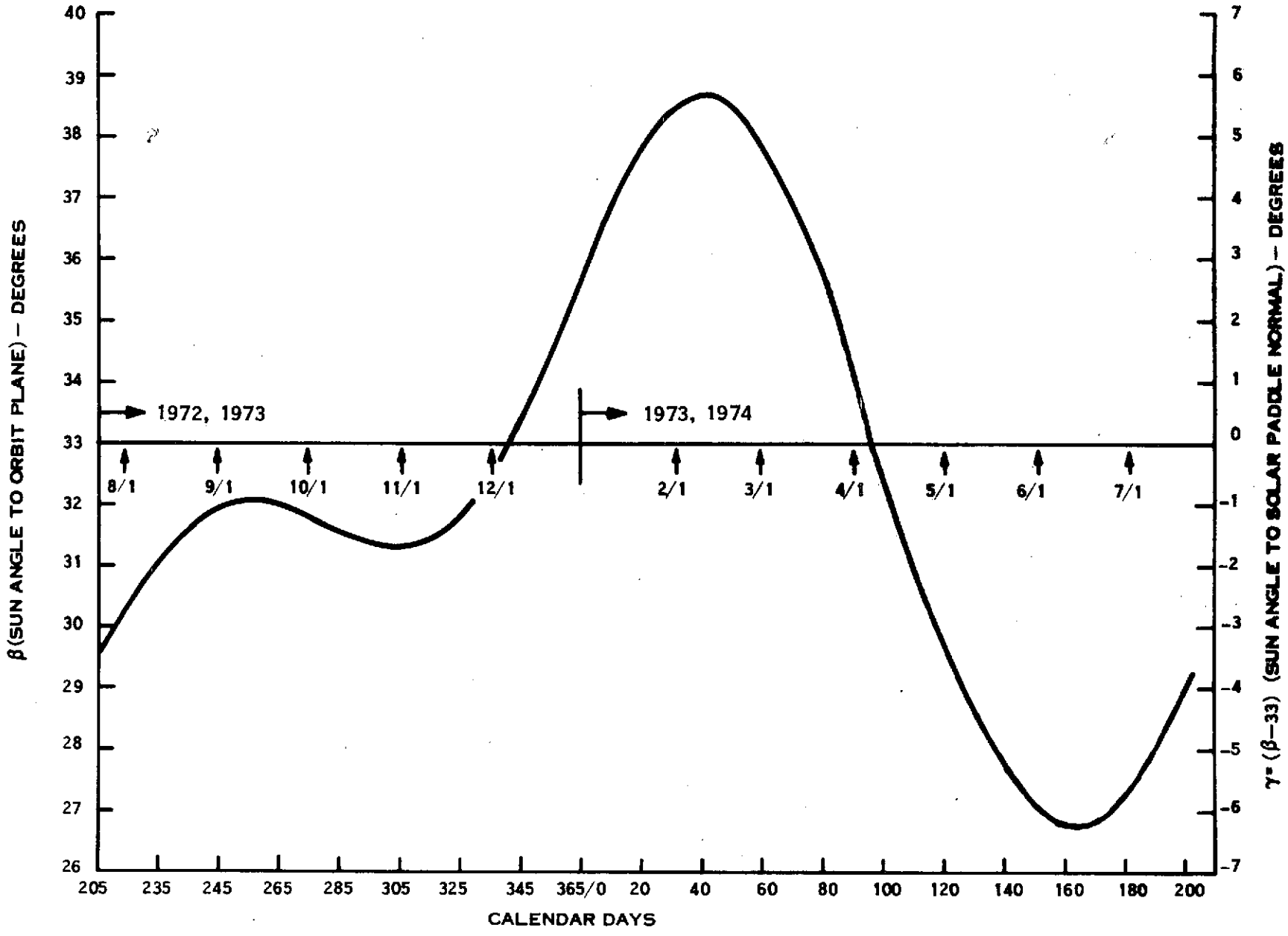


Figure 3-3. Actual and Predicted β and Paddle Sun Angles

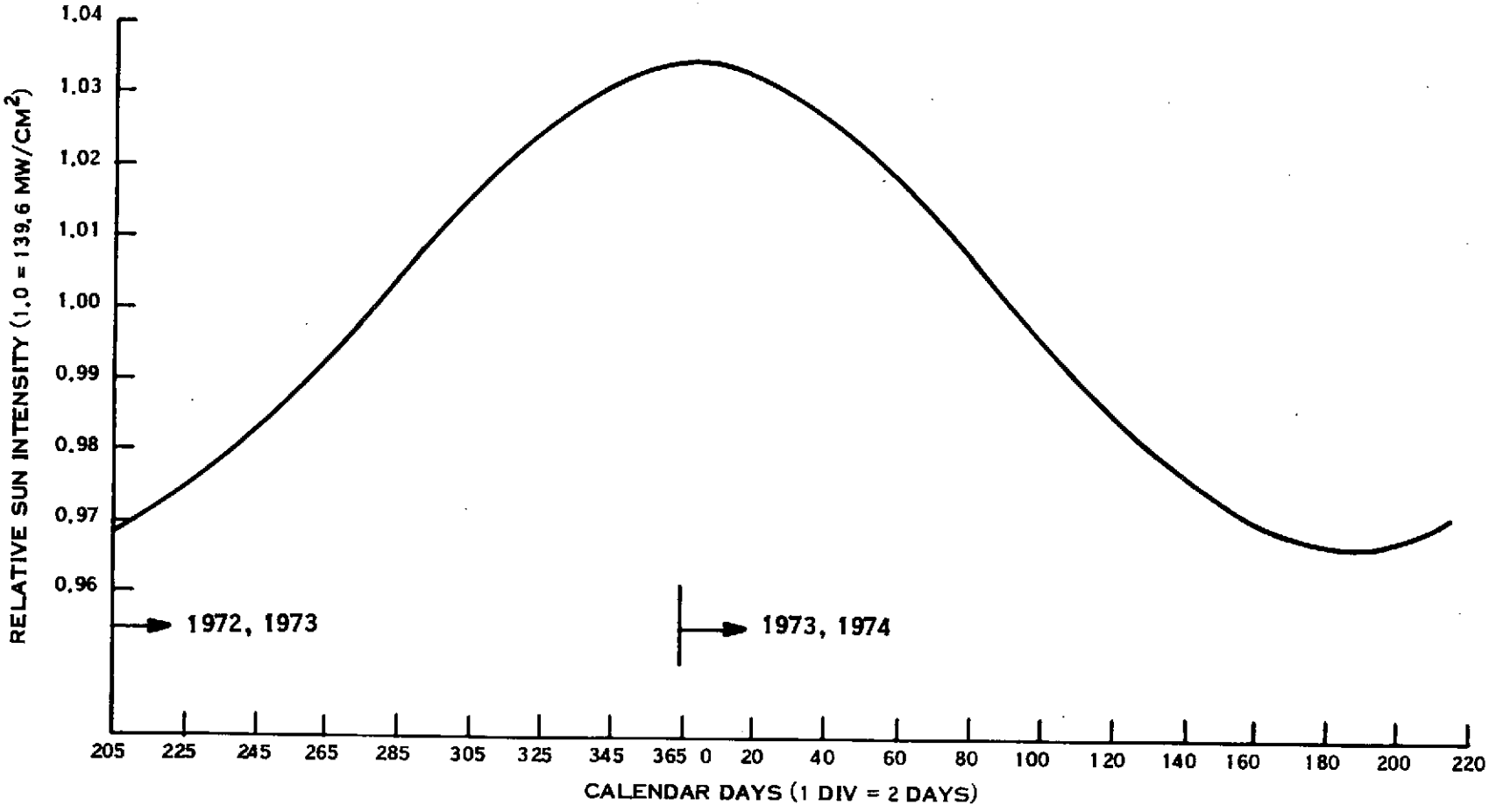
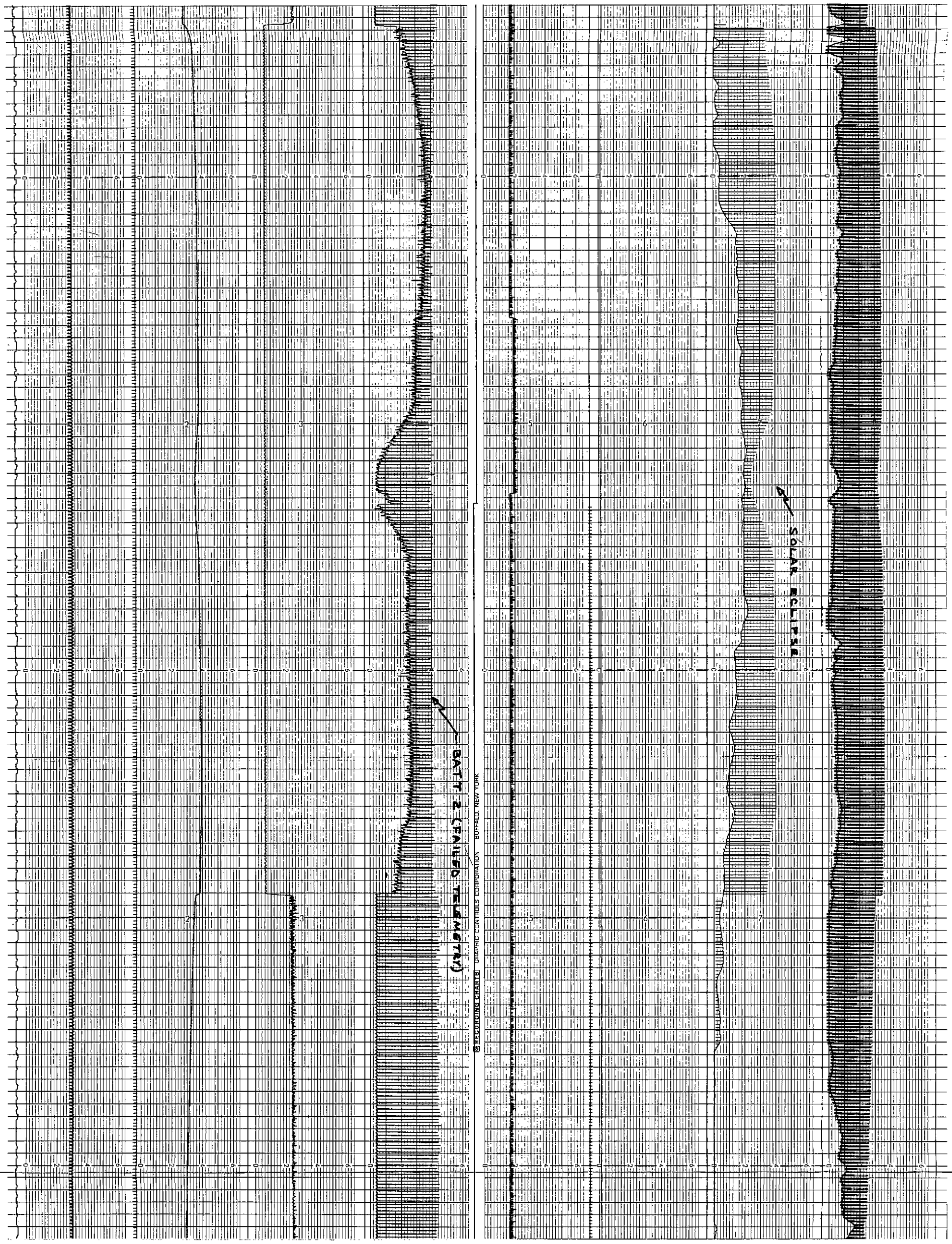


Figure 3-4. Seasonal Solar Intensity Variation

FOLDOUT FRAME 1



OFF ON PWR PWM REG. 1 & 2	OFF ON PWR PWM REG 2 & 4	OFF ON PWR SHUNTS A, B, C, D	OFF ON PWR AUX 1 & 2	OFF ON PWR AUX 3 & 4	OFF ON PWR AUX 5	NOR OVRD PWR TRKL CHG
CI8R0 CI8RI	CI5R0 CI5RI	CIR0, CIRI, CIR2, CIR3	C2R0 C2RI	C2R2 C2R3	CI0R3	CI8R2
F6061 F6062	F6077 F6078	F6089 thru F6092	F6093 F6094	F6095 F6096	F6097	F6260

PWR	PWR	PWR	PWR	PWR	PWR	PWR/AMS	PWR/AMS
BATT 1 thru 8 TEMP	BATT 1 thru 8 VOLTS	BATT 1 thru 8 DISC CURRENT	BATT 1 thru 8 CHG CURRENT	S/C REG BUS CURRENT	P/I REG BUS CURRENT	ARRAY CURRENT & AMS ROLL	P/L UN REG BUS VOLT & S/C UN REG BUS VOLT & AMS PITCH
CI5R8, CI8R17, CIR27 C2R36, C8R45, CI0R54 CI2R63, CI5R72	CI2R80, CI5R17, CI8R26 CIR36, C2R45, C8R54 CI0R63, CI2R72	C8R8, CI0R17, CI2R26 CI5R35, CI8R44, CIR54 C2R63, C8R72	CI0R8, CI2R17, CI5R26 CI8R35, CIR45, C2R54 C8R63, CI0R72	C6R0 & CI3R20	C7R2 & CI7R4	CIR9 & CIIR3	CI0R32, CI8R8, C4R4
I/I6 ALL F6031 thru F6038	I/I6 ALL F6021 thru F6028	I/I6 ALL F6001 thru F6008	I/I6 ALL F6011 thru 6018	I/I I/I F6055 & F6056	I/I I/I F6072 & F6100	I/I6 I/I F6054 & F3001	I/I6 I/I6 I/I F6071 & F6050 & F3003

GENERAL STATUS #5

FOLDOUT FRAME 2

Figure 3-5. Power Functions in Eclipse of Orbit 4765

Table 3-1. Major Power Subsystems Parameters

Orbit No.			26	1291	2600	3810	4201	4601	5098
Batt	1	Max	32.48	32.99	32.91	32.82	32.82	32.99	32.91
	2	Chge	32.48	32.99	32.91	32.82	32.82	32.99	32.91
	3	Volts	32.48	32.99	32.91	32.91	32.91	33.08	32.99
	4		32.48	32.99	32.91	32.91	32.91	33.08	32.99
	5		32.48	32.08	32.99	32.91	32.91	33.16	32.99
	6		32.31	32.99	32.91	32.91	32.91	33.08	32.91
	7		32.22	32.99	32.91	32.91	32.91	33.08	32.91
	8		32.14	32.99	32.91	32.91	32.91	33.08	32.99
	Average		32.28	33.00	32.92	32.86	32.88	33.07	32.95
Batt	1	End-	28.81	28.55	28.12	28.98	29.15	29.15	28.30
	2	of-	28.81	28.55	28.12	28.98	29.15	29.15	28.30
	3	Night	28.21	28.55	28.04	28.89	29.15	29.15	28.30
	4	Volts	28.89	28.55	28.12	28.98	29.15	29.15	28.38
	5		28.29	28.64	28.21	29.06	29.23	29.23	28.38
	6		28.81	28.55	28.04	28.89	29.06	29.15	28.30
	7		28.89	28.55	28.12	28.98	29.15	29.15	28.30
	8		28.81	28.55	28.12	28.98	29.15	29.15	28.30
	Average		28.84	28.56	28.11	28.97	29.15	29.16	28.32
Batt	1	Chge	13.11	13.29	13.00	13.76	13.89	13.75	13.58
	2	Share	12.93	12.95	13.00	13.63	13.71	*13.75	*13.58
	3	(%)	11.38	11.23	11.53	11.60	11.61	11.45	11.38
	4		12.39	12.29	12.13	12.36	12.39	12.41	11.95
	5		12.32	12.30	12.41	11.93	11.80	11.92	11.85
	6		12.80	12.74	12.82	12.21	12.14	12.22	12.35
	7		12.62	12.83	12.66	12.44	12.35	12.35	12.42
	8		12.45	12.36	12.45	12.05	12.11	11.90	12.10
Batt	1	Load	12.71	12.68	12.61	12.63	12.37	12.46	12.44
	2	Share	12.90	13.71	13.43	13.84	14.02	13.58	13.62
	3	(%)	11.43	12.09	12.11	12.18	12.12	11.98	11.91
	4		12.77	12.89	12.88	12.94	13.14	13.12	13.01
	5		12.54	12.32	12.29	12.20	12.29	12.46	12.42
	6		12.53	12.24	12.29	11.93	12.01	11.98	12.21
	7		12.80	12.33	12.27	12.55	12.34	12.63	12.41
	8		12.32	11.74	12.12	11.74	11.71	11.78	11.98
Batt	1	Temp	21.11	24.63	25.13	24.35	24.72	24.14	24.65
	2	in	18.74	21.37	22.33	21.69	21.96	21.14	21.42
	3	(°C)	18.77	20.36	20.72	20.31	20.63	20.21	20.29
	4		21.57	23.41	23.23	22.99	23.64	23.43	23.17
	5		21.02	24.67	26.77	23.77	23.61	23.24	23.85
	6		21.21	24.98	26.95	24.23	24.11	23.62	24.37
	7		21.41	25.64	27.18	24.73	24.87	24.26	25.01
	8		21.82	25.67	26.68	24.89	25.15	24.56	25.14
	Average		20.81	23.84	24.87	23.37	23.59	23.08	23.49
S/C Reg Bus Pwr (W)			176.8	168.0	182.3	170.5	157.1	171.8	153.4
Comp Load Part (W) P/O S/C Reg Bus Pwr			49.0	41.8	34.8	34.8	34.8	34.8	34.8
P/L Reg Bus Pwr (W)			16.2	19.6	36.1	8.9	15.3	8.6	13.7
C/D Ratio			1.06	1.17	1.08	1.18	1.16	1.17	1.13
Total Charge (A-M)			309.2	296.8	353.85	269.05	265.43	266.42	290.21
Total Discharge (A-M)			290.9	253.6	327.08	227.97	229.56	228.05	256.28
Solar Array (A-M)			1044	1033	1028	952	927	908	908
S.A. Peak I (A)			16.8	15.36	15.10	14.21	14.04	13.68	13.68
Beta Angle (DEG)			-3.33	-1.65	+5.15	-0.90	-5.74	-6.10	-3.54
Max R Pad Temp (°C)			+65.0	+71.	+71.00	+68.00	+68.00	+68.00	+68.00
Min R Pad Temp (°C)			-62.0	58.0	-56.00	-59.00	-61.00	-62.00	-59.00
Max L Pad Temp (°C)			+57.9	+65.0	+66.00	+61.37	+60.50	+61.37	+60.50
Min L Pad Temp (°C)			-67.0	-64.0	-60.00	-64.00	-67.00	-67.00	-64.00

*After the telemetry failure in Orbit 4396 battery 2 charge share was taken equal to battery 1 charge share as an approximation.

Table 3-2. Power Subsystem Analog Telemetry (Average Value for Frames of Data Received in NBTR Playback)

Function	Description	Unit	Orbit 26	Orbit 1291	Orbit 2600	Orbit 3810	Orbit 4201	Orbit 4601	Orbit 5098
6001	Bat 1 Disc	Amp	0.94	0.96	1.23	0.71	0.74	0.67	0.81
6002	2		0.95	1.03	1.29	0.78	0.64	*	*
6003	3		0.84	0.91	1.17	0.69	0.72	0.66	0.78
6004	4		0.93	0.98	1.23	0.78	0.78	0.74	0.86
6005	5		0.92	0.93	1.19	0.75	0.74	0.72	0.82
6006	6		0.91	0.93	1.20	0.70	0.72	0.66	0.78
6007	7		0.94	0.96	1.19	0.73	0.73	0.68	0.82
6008	8		0.91	0.90	1.18	0.73	0.70	0.72	0.77
6011	Bat 1 Chg		0.58	0.58	0.71	0.57	0.53	0.63	0.58
6012	2		0.57	0.56	0.71	0.57	0.52	*	*
6013	3		0.50	0.49	0.63	0.48	0.44	0.52	0.48
6014	4		0.54	0.54	0.66	0.51	0.47	0.57	0.51
6015	5		0.54	0.54	0.68	0.49	0.45	0.54	0.50
6016	6		0.57	0.55	0.70	0.51	0.47	0.55	0.52
6017	7		0.55	0.56	0.70	0.52	0.48	0.57	0.53
6018	8		0.55	0.54	0.69	0.50	0.46	0.55	0.52
6021	Bat 1 Volt	VDC	30.87	31.28	30.74	31.19	31.27	31.61	31.24
6022	2		30.87	31.28	30.74	31.19	31.28	31.62	31.25
6023	3		30.87	31.29	30.74	31.19	31.27	31.62	31.25
6024	4		30.90	31.32	30.77	31.22	31.31	31.65	31.28
6025	5		30.95	31.36	30.82	31.28	31.36	31.70	31.33
6026	6		30.86	31.27	30.72	31.18	31.26	31.61	31.24
6027	7		30.89	31.30	30.76	31.21	31.29	31.63	31.27
6028	8		30.89	31.30	30.75	31.21	31.29	31.63	31.27
6031	Bat 1 Temp	DGC	21.17	24.61	25.19	24.28	24.55	24.28	24.48
6032	2		18.80	21.36	22.44	21.55	21.78	21.08	21.29
6033	3		18.76	20.36	20.80	20.27	20.48	20.14	20.17
6034	4 4		21.57	23.41	23.20	22.94	23.54	23.25	23.04
6035	5		21.84	24.64	26.86	23.73	23.50	23.22	23.77
6036	6		21.24	24.99	26.99	24.17	23.94	23.74	24.27
6037	7		21.43	25.67	27.20	24.65	24.66	24.39	24.88
6038	8		21.86	25.66	26.75	24.87	25.03	24.70	25.02
6040	RT Pad Temp	DGC	25.82	30.33	27.98	28.46	26.29	35.31	27.22
6041	R Pad V N	VDC	33.40	33.96	33.01	33.77	33.91	34.10	33.85
6042	R Pad V M	VDC	33.29	33.59	32.43	33.34	33.80	34.12	33.50
6044	Lt Pad Temp	DGC	14.14	19.50	18.56	17.78	15.99	25.62	16.61
6045	L Pad V F	VDC	33.69	34.26	33.71	34.08	34.18	34.40	34.16
6046	L Pad V G	VDC	33.68	34.27	33.73	34.09	34.24	34.43	34.19
6050	S/C Ur Bus V	VDC	31.24	31.69	31.03	31.54	31.61	31.99	31.68
6051	S/C Rg Bus V	VDC	24.54	24.55	24.54	24.54	24.54	24.55	24.55
6052	Aux Reg A V	VDC	23.41	23.47	23.48	23.48	23.48	23.48	23.48
6053	Aux Reg B V	VDC	23.50	23.50	23.50	23.50	23.50	23.50	23.50
6054	Solar I	Amp	14.87	14.40	13.97	13.28	13.03	12.82	12.69
6055	S/C Rg Bus I	Amp	7.11	6.86	7.45	6.98	6.42	7.03	6.27
6056	S/C Rg Bus I	Amp	7.11	6.85	7.46	6.96	6.42	7.02	6.27
6058	PC Mod T1	DGC	21.82	22.81	23.53	22.78	22.63	22.93	22.23
6059	PC Mod T2	DGC	21.68	22.74	23.08	22.70	22.76	22.64	22.53
6070	P/L Rg Bus V	VDC	24.66	24.68	24.67	24.67	24.68	24.68	24.68
6071	P/L Ur Bus V	VDC	31.08	31.54	30.88	31.39	31.46	31.84	31.53
6072	P/L Rg Bus I	Amp	0.57	0.79	1.47	0.36	0.63	0.35	0.56
6073	P Aux A V	VDC	23.51	23.52	23.53	23.50	23.51	23.50	23.51
6074	P Aux B V	VDC	23.51	23.52	23.53	23.50	23.51	23.50	23.51
6075	Pr Mod T1	DGC	21.50	23.15	24.40	23.25	23.45	23.17	23.13
6076	Pr Mod T2	DGC	20.34	21.47	22.31	21.25	21.70	21.43	21.45
6079	Fuse Blow V	VDC	24.56	*	*	**	24.57	24.58	24.57
6080	Shunt 1 I	Amp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6081	2		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6082	3		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6083	4		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6084	5		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6085	6		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6086	7		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6087	8		0.00	0.00	0.00	0.00	0.00	0.00	0.00
6100	P/L Rg Bus I	Amp	0.58	0.79	1.47	0.36	0.63	0.35	0.56
Total No.	Major Frames	FRM	764	390	425	384	380	570	389

* Function 6002, 6012; missing data resulted from disabled telemetry resulting from IC clip failure which affected charge current directly and discharge current indirectly via the power computer program.

** Function 6079; missing data resulted from logic in error in master information file used in computer processing.

SECTION 4

ATTITUDE CONTROL SUBSYSTEMS

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)

Performance of the Attitude Control Subsystem has been excellent throughout the launch and orbital operations during the past year.

Infrared horizon scanner signals have been normal and processing through the signal processing circuitry has been nominal with orbit average reaction wheel modulator duty cycles remaining constant at 5 to 6% for roll, 1 to 2% for yaw and 7 to 8.5% for pitch. Near orbit 1870 the yaw duty cycle rose to 5% and remained at that level until near Orbit 3500 when it settled back to 1 to 2% where it has remained during this report period.

Near Orbit 1890 the roll duty cycle rose to 7% and then settled back to 5% over several orbits where it has remained during this report period.

Near Orbit 2150 the pitch duty cycle rose abruptly to 25% for one orbit and settled back to 7 to 8.5% over several orbits where it has remained during this reporting period.

Occasional small excursions in the duty cycle have occurred since, but none has remained more than a few orbits.

Pressure/temperature ratios have all been satisfactory. The forward scanner pressure has decreased slightly since launch (4.6 PSI at launch, 4.02 PSI at Orbit 5099). See Figure 4-1. However, it is not decreasing at a rate fast enough to cause alarm.

All pneumatic gating functions are performing well with no evidence of propellant leaks. The (+) Pitch and (-) Roll gate history is shown in Figure 4-2. There is close correlation between gating frequency and sun intensity; there appears to be correlation with Beta angle as well as WBVTR operation as shown in Figures 4-3, 4-4, 4-5. More orbital operations data are required to establish a specific pattern with possibly conclusive correlation. Usable impulse remaining is 493.0 lb-sec. See Table 4-1 for ERTS impulse usage.

Rate Measuring Package '2' is still performing well. RMP '1' was not operated during this period.

The Solar Array Drives performed well during this period. The output signature for the left SAD continues to change as noted in Figure 4-6. The change is attributed to gear wear-in.

The right cosine pot has developed a consistent signal deviation at midnight (spacecraft time). See Figure 4-7. An additional signal deviation is beginning to appear at 10 minutes before midnight. These deviations do not interfere with normal operations; however, they are continuing to degrade signal output. Table 4-2 gives typical ACS telemetry values.

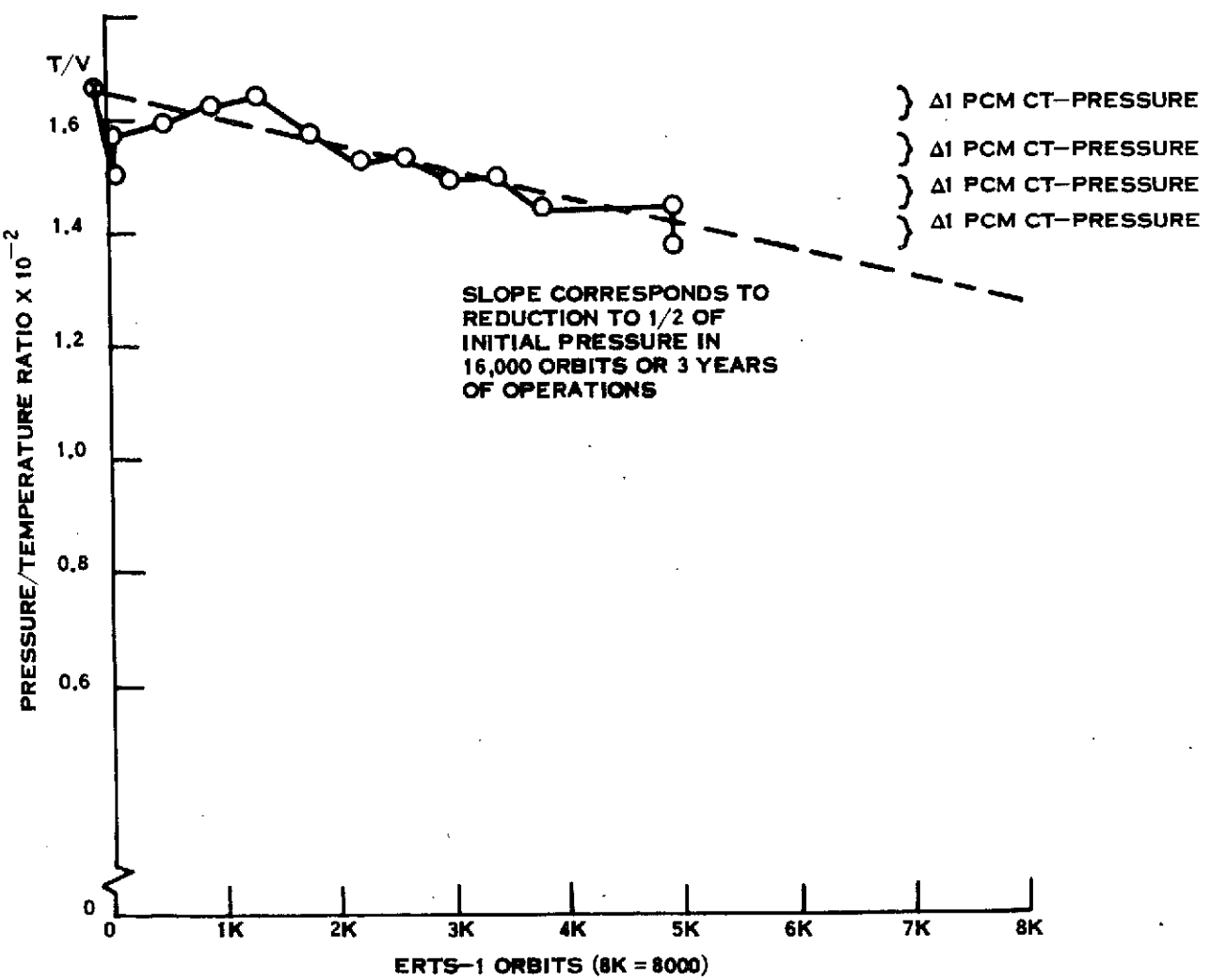


Figure 4-1. Forward Scanner P/T Ratio

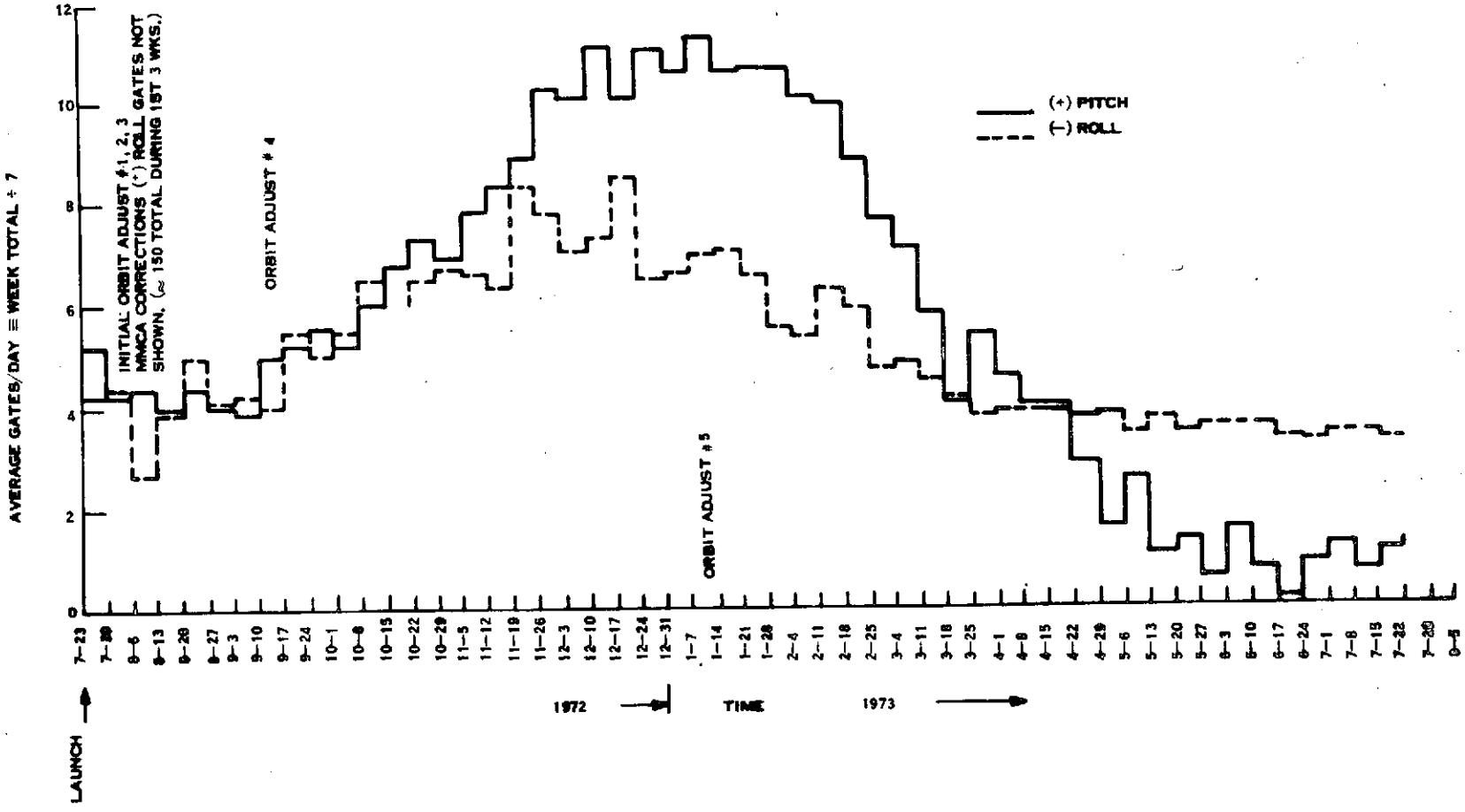


Figure 4-2. ERTS-1 Gating Frequency vs Time

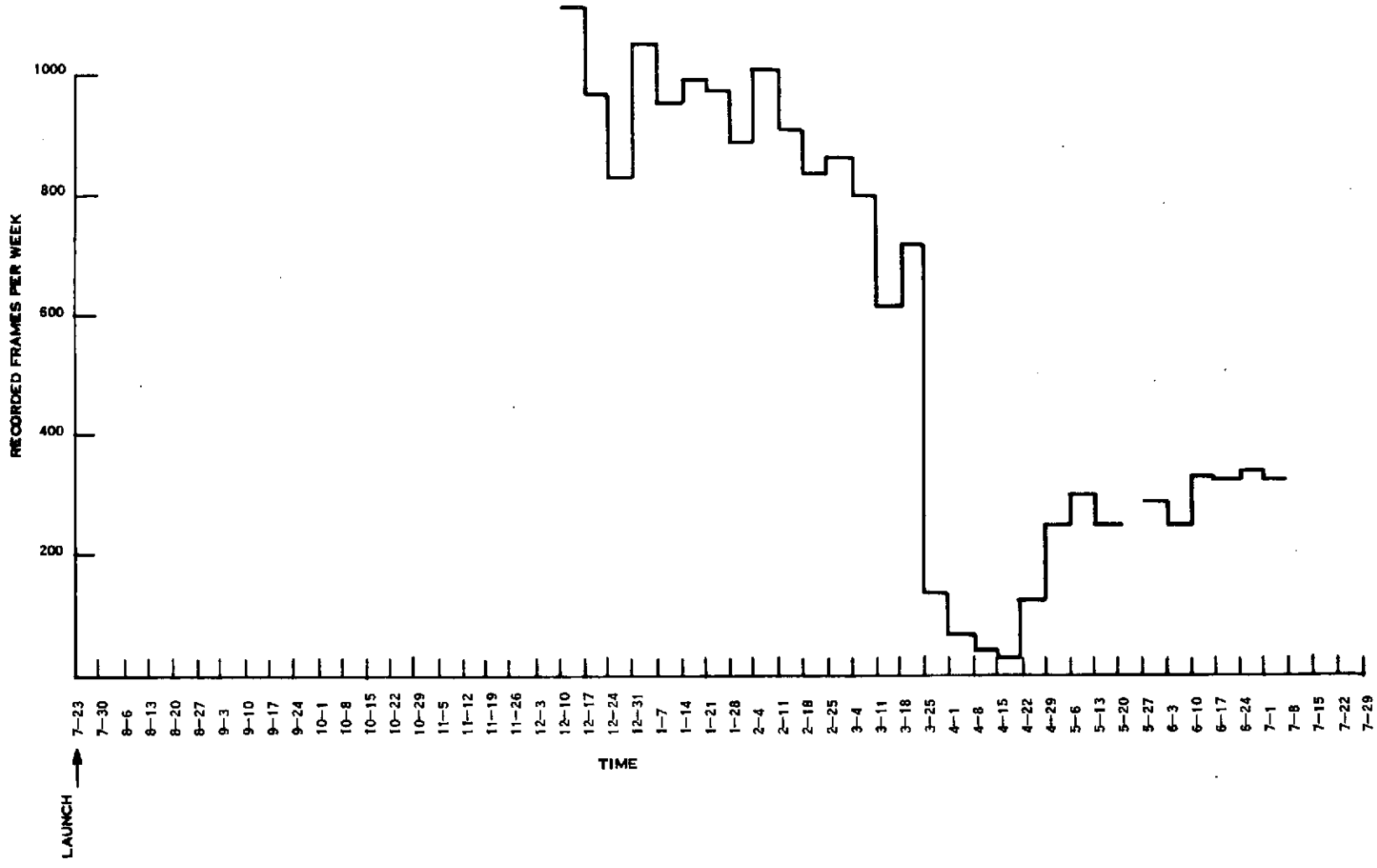


Figure 4-3. Wideband Video Tape Recorder No. 1 Tape Utilization

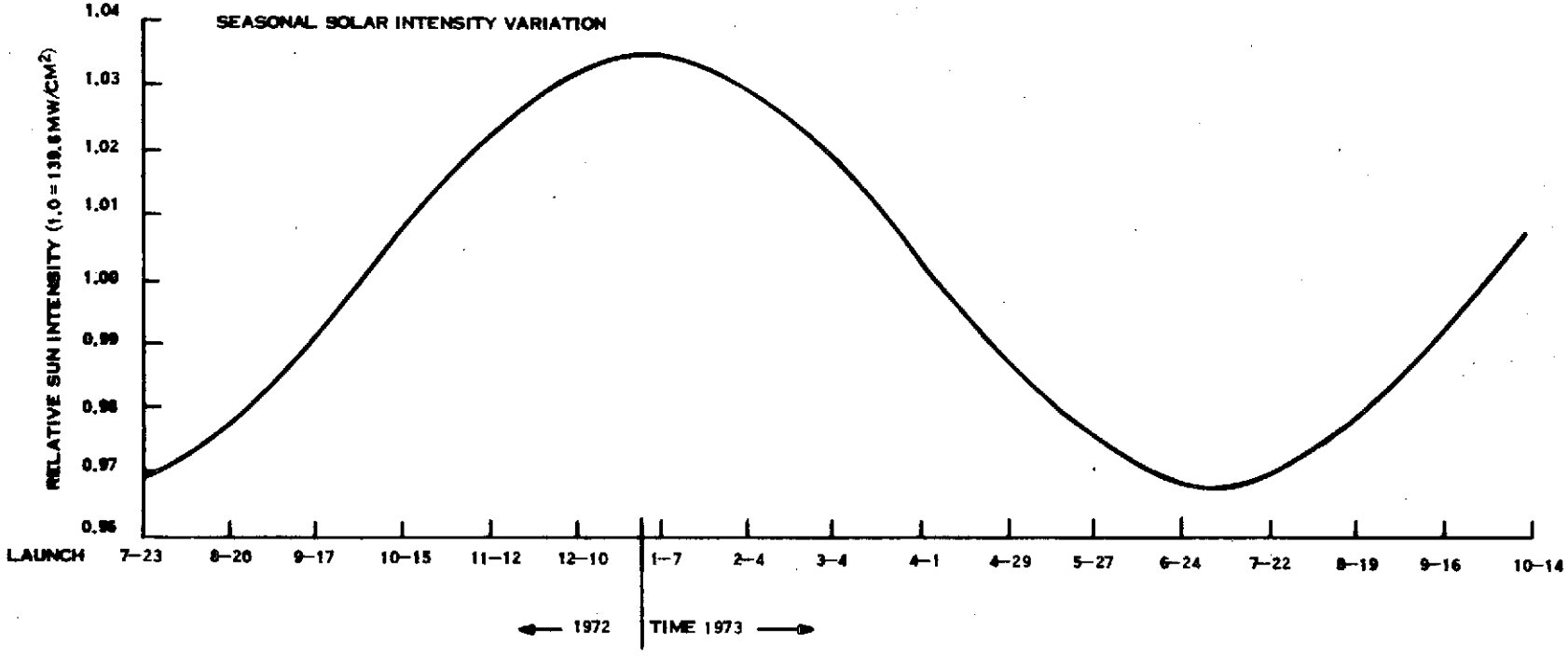


Figure 4-4. ERTS-1 Seasonal Solar Intensity Variations

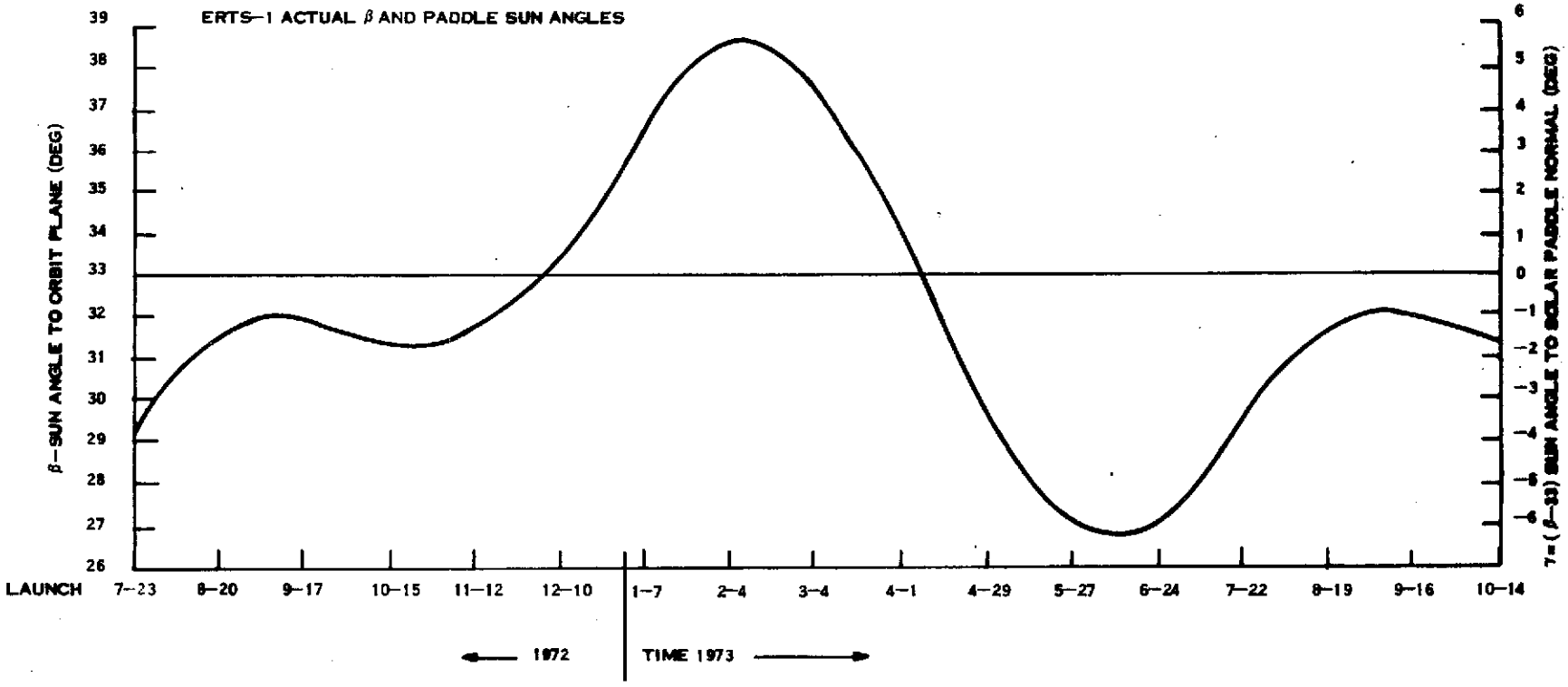


Figure 4-5. Actual Beta and Paddle Sun Angles

Table 4-1. Impulse Usage ERTS-1

Item	Units	Orbits				
		0/1	1300	2600	3800	5099
Gas (Attitude)						
Remaining (2)	Lbs	12.02	11.63	11.00	10.60	10.52
Usable Impulse (3)	Lb-Sec	575.2	555.7	524.2	504.2	500.4
Gates	Cumulative					
- Pitch		--	0	0	0	0
+ Pitch		--	475	1431	2025	2142
- Roll		--	375	1030	1440	1768
+ Roll		--	150	153 (1)	153	158 (4)
$W = \frac{PV}{CRT}$						

Where:

W = Weight of Freon-14 in lbs

P = Tank pressure in lbs/ft^3

V = Tank volume in ft^3 (0.272 for ERTS-1)

C = Compressibility factor for Freon-14

R = Universal gas constant (17.55 for Freon-14)

T = Tank temperature degrees Rankine

(1) 3 (+) roll gates during orbit adjust (Orbit 2416)

(2) 0.516 lbs of Freon not usable due to manifold lock up pressure

(3) Freon-14 specific impulse = 50 lb-sec/lb

(4) 2 (+) roll gates Orbit 4281, 1 (+) roll gates Orbit 4613, 2 (+) roll gates Orbit 4982, by pneumatic enables during satellite day.

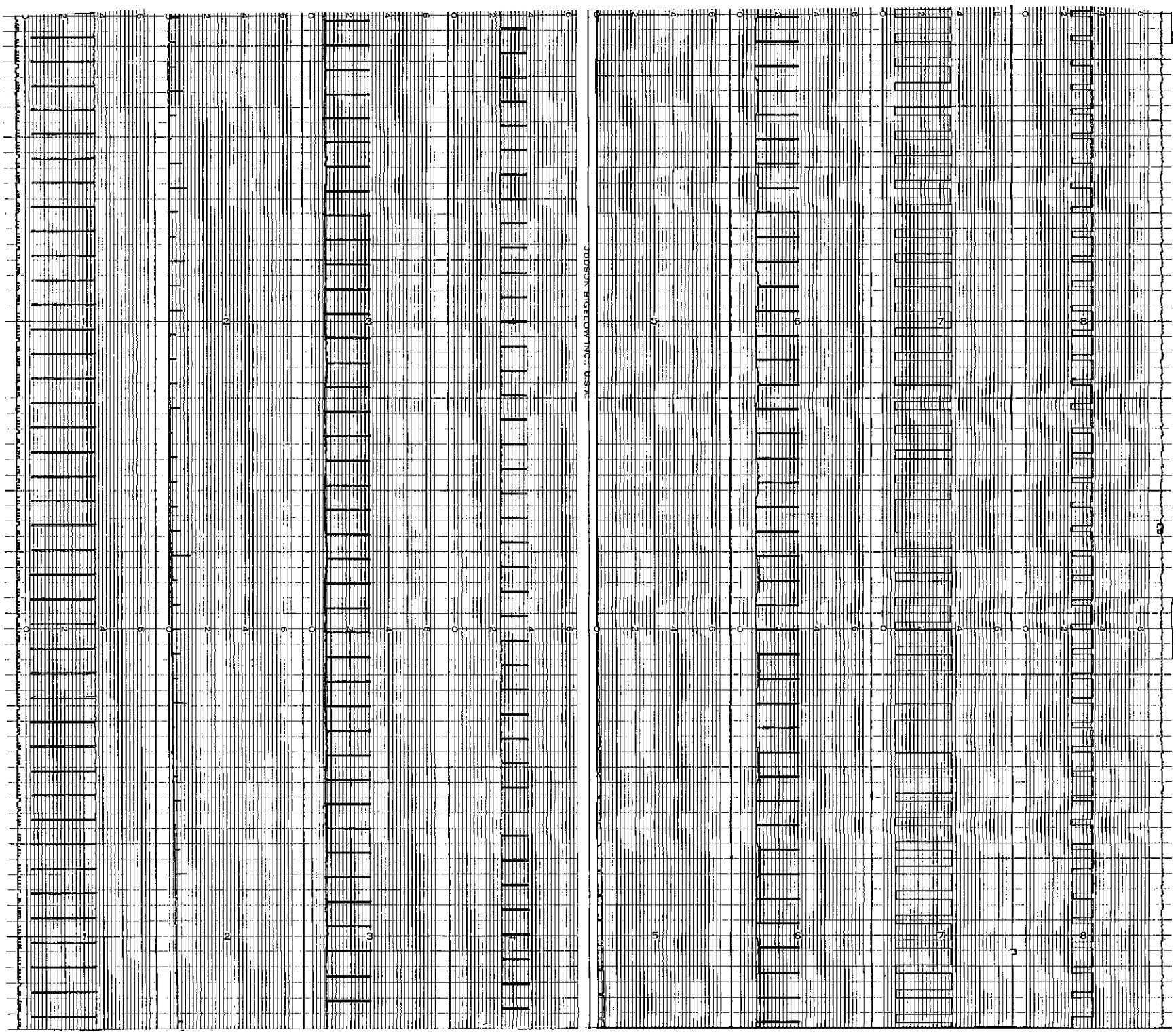
Table 4-2. ACS Temperature and Pressure Telemetry Summary

Function	Units	*T/V 20°C Plateau	Orbit			
			31	4300	4700	5099
1084 RMP 1 Gyro Temperature	DGC	79.0	44.5	23.23	23.29	23.06
1094 RMP 2 Gyro Temperature	DGC	73.0	74.3	75.07	75.08	75.10
1222 SAD RT MTR HSING Temp	DGC	28.0	21.1	22.24	22.21	22.00
1242 SAD LT MTR HSING Temp	DGC	27.0	27.0	30.52	30.39	30.38
1223 SAD RT MTR WNDNG Temp	DGC	29.0	25.3	26.70	26.70	26.54
1243 SAD LT MTR WNDNG Temp	DGC	29.0	28.7	32.96	32.99	32.92
1228 SAD RT HSG Pressure	PSI	7.57	7.6	7.41	7.41	7.35
1248 SAD LT HSG Pressure	PSI	6.91	7.0	6.87	6.87	6.86
1007 FWD Scanner MTR Temp	DGC	17.00	19.8	19.94	19.86	19.88
1016 Rear Scanner MTR Temp	DGC	25.00	20.5	20.03	19.92	19.83
1003 FWD Scanner Pressure	PSI	4.80	4.6	4.20	4.20	4.02
1012 Rear Scanner Pressure	PSI	5.16[1]	7.8	7.87	7.88	7.87
1212 Gas Tank Pressure	PSI	1810.	1988.	1732.45	1732.35	1702.34
1210 Gas Tank Temperature	DGC	20.0	22.6	24.54	24.54	24.30
1213 Manifold Pressure	PSI	57.53	56.7	57.50	57.51	57.44
1211 Manifold Temperature	DGC	24.0	21.9	23.82	23.74	23.62
1059 CLB Power Supply Card Temp	DGC	36.0	37.1	40.53	40.44	40.54
1260 THO1 EBP	DGC	26.0	25.4	28.18	27.96	27.93
1081 RMP 1 MTR Volts	VDC	-30.13	Off	OFF	OFF	OFF
1082 RMP 1 MTR Current	Amps	0.11	Off	OFF	OFF	OFF
1080 RMP 1 Supply Volts	VDC	-23.88	Off	OFF	OFF	OFF
1091 RMP 2 MTR Volts	VDC	-29.68	-29.7	-29.63	-29.63	-29.63
1092 RMP 2 MTR Current	Amps	0.10	0.10	0.10	0.10	0.10
1090 RMP 2 Supply Volts	VDC	-23.46	-23.4	-23.41	-23.40	-23.41
1220 SAD RT MTR WNDNG Volts	VDC	-5.0	-4.8	-4.24	-4.21	-4.25
1240 SAD LT MTR WNDNG Volts	VDC	-5.2	-4.8	-4.13	-4.17	-4.09
1227 SAD RT -15 VDC Conv.	VDC	-14.88	14.9	14.89	14.90	14.88
1247 SAD LT -15 VDC Conv.	VDC	-15.12	15.2	15.14	15.15	15.13
1056 CLB ± 6 VDC	TMV	2.33	2.4	2.35	2.35	2.35
1055 CLB ± 10 VDC TMV	TMV	2.73	2.75	2.75	2.75	2.75
1057 CLB Power Supply Volts	TMV	2.77	2.8	2.78	2.78	2.78
1261 THO2 EBP	DGC	23.0	22.9	24.95	24.73	24.73
1262 THO3 EBP	DGC	25.0	23.4	23.96	23.82	23.69
1263 THO1 STS	DGC	-8.0	-6.8	0.50	-2.44	-0.97
1264 THO2 STS	DGC	-11.0	-14.6	-6.61	-11.41	-9.42
1265 THO3 STS	DGC	-12.0	-3.1	9.20	6.71	9.31
1266 THO4 STS	DGC	4.0	-13.9	0.04	0.95	2.85
1267 THO5 STS	DGC	-2.0	-8.9	1.78	-3.34	-1.16
1224 SAD R FSST	DGC	28.0	39.5	62.30	59.41	60.21
1244 SAD L FSST	DGC	22.0	27.1	51.88	50.22	51.11

[1] Scanner S/N FT-3 in thermo-vacuum scanner - S/N FT-6 in flight

* Thermal Vacuum Test Data

FOLDOUT FRAME 1



ENA	DIS	CCW	CW	HIGH	NOR	CCW	CW	HIGH	NOR	LOCK	UNLOCK	TOC	TICK		
ACS		ACS		ACS		ACS		ACS		ACS		CMD			
400 RPM INTERLOCK		SAD LEFT PH SW		SAD LEFT RATE B		SAD RIGHT PH SW		SAD RIGHT RATE B		SINGLE SCAN MODE		CMD CLOCK VER			
CI2RI		C2R2		CIR2		CI8RI		CI5RI		CI0RI		CI7R3			
FI06I		FI250		FI249		FI230		FI229		FI290		F8057			

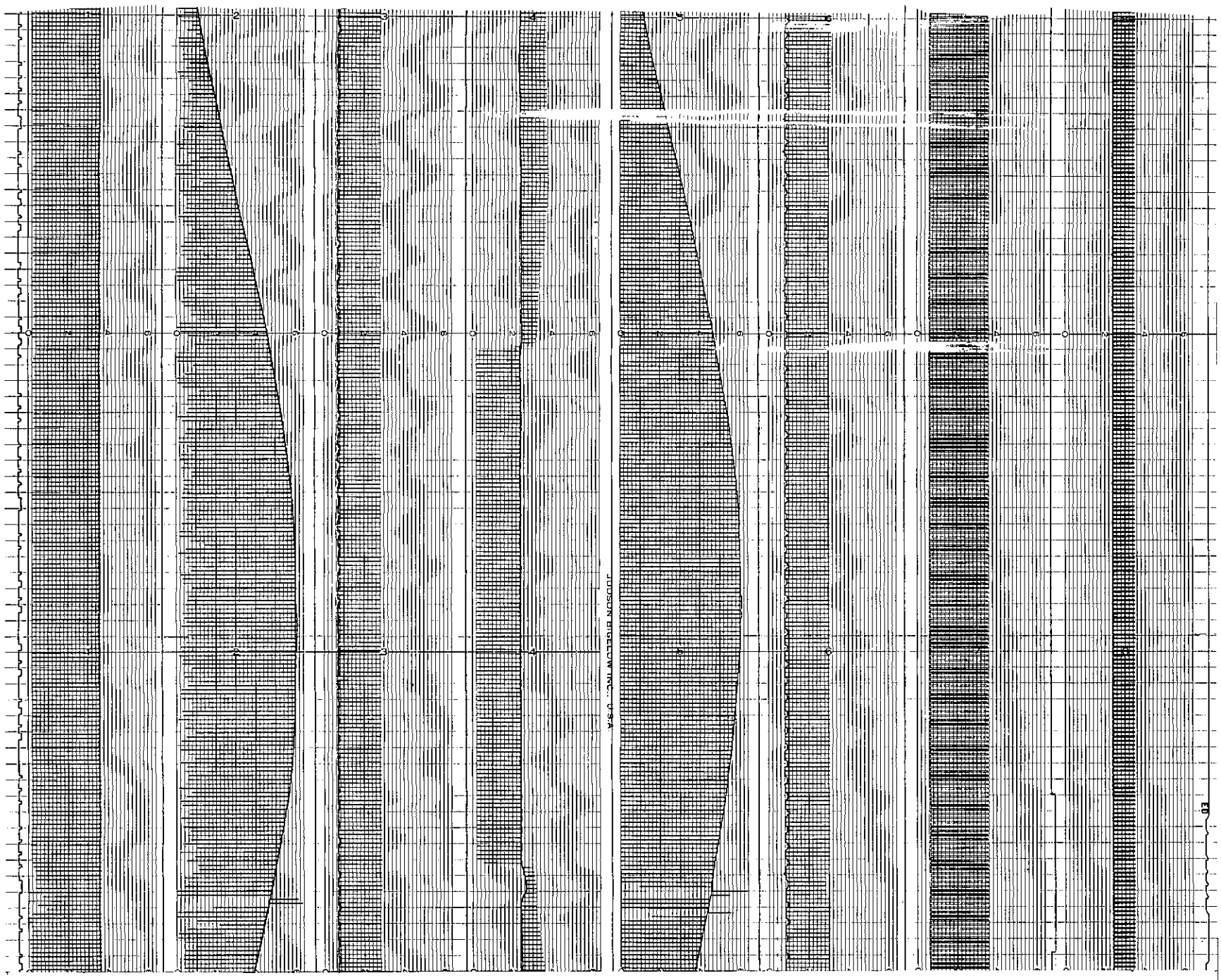
ACS		ACS		ACS		PWR/ACS		ACS		ACS		ACS		ACS	
PITCH TACH AMP & SAD LEFT TACH		LEFT SAD COSINE & PITCH MTR DR CCW		SAD LEFT SUN SEN & SAD LEFT MTR WINDING		ARRAY CURRENT & SAD RIGHT TACH		RIGHT SAD COSINE & PITCH MTR DR CW		SAD RIGHT SUN SEN & SAD RIGHT MTR WINDING		RMP #I MTR CURRENT & MANIFOLD PRESS		RMP #2 MTR CURRENT & TANK PRESS	
CIR64	C7R3	CI3R4	C8R46	CI8R34	C6R3	CIR9	C5R3	CIIR4	CI5R54	C8R44	C4R3	CI5R44	CI8R7I	CI2R44	CI5R62
I/I6	I/I	I/I	I/I6	I/I6	I/I	I/I6	I/I	I/I	I/I6	I/I6	I/I	I/I6	I/I6	I/I6	I/I6
FI042	FI24I	FI293	FI038	FI246	FI240	F6054	FI22I	FI292	FI039	FI226	FI220	FI082	FI2I3	FI092	FI2I2

GENERAL STATUS #4

FOLDOUT FRAME 2

Figure 4-6. Orbit 5073 Realtime TLM

FOLDOUT FRAME 1



ENA DIS	CCW CW	HIGH NOR	CCW CW	HIGH NOR	LOCK UNLOCK	TOC TICK
ACS	ACS	ACS	ACS	ACS	ACS	CMD
400 RPM INTERLOCK CI2RI FI06I	SAD LEFT PH SW C2R2 FI250	SAD LEFT RATE B CIR2 FI249	SAD RIGHT PH SW CI8RI FI230	SAD RIGHT RATE B CI5RI FI229	SINGLE SCAN MODE C10RI FI290	CMD CLOCK VER CI7R3 F8057

ACS	ACS	ACS	PWR/ACS	ACS	ACS	ACS	ACS
PITCH TACH AMP & SAD LEFT TACH	LEFT SAD COSINE & PITCH MTR DR CCW	SAD LEFT SUN SEN & SAD LEFT MTR WINDING	ARRAY CURRENT & SAD RIGHT TACH	RIGHT SAD COSINE & PITCH MTR DR CW	SAD RIGHT SUN SEN & SAD RIGHT MTR WINDING	RMP #1 MTR CURRENT & MANIFOLD PRESS	RMP #2 MTR CURRENT & TANK PRESS

CIR64	C7R3	CI3R4	C8R46	CI8R34	C6R3	CIR9	C5R3	CIIR4	CI5R54	C8R44	C4R3	CI5R44	CI8R7I	CI2R44	CI5R62
1/16	1/1	1/1	1/16	1/16	1/1	1/16	1/1	1/1	1/16	1/16	1/1	1/16	1/16	1/16	1/16
FI042	FI24I	FI293	FI038	FI246	FI240	F6054	FI22I	FI292	FI039	FI226	FI220	FI082	FI2T3	FI092	FI2I2

GENERAL STATUS #4

FOLDOUT FRAME 2

Figure 4-7. Orbit 5096 NBR P/B Telemetry

SECTION 5

COMMAND/CLOCK SUBSYSTEM

SECTION 5

COMMAND/CLOCK SUBSYSTEM (CMD)

Command processing for both real time and stored commands for ERTS-1 has been normal during this period.

Commanding difficulties which have been experienced have been isolated to ground transmission problems.

Missed commands, attributed to the logic race in the command clock design, are occasionally noted.

The spacecraft time base, provided by the time code generator, has been well within specifications. Drift has averaged -1.025 M.S./orbit during this period. For the full year, 5100 orbits, the drift average has been -1.10705 M.S./orbit. The clock has been reset once in orbit, at the beginning of 1973. See Figure 5-1.

There has been no requirement to switch to alternate units from original configuration.

Cell 12 in COMSTOR 'B" has intermittently exhibited a 256 second delta (both high and low) from desired execute time since Orbit 583. Performance has appeared to degrade as noted in Table 5-1, usually one retransmission would correct the time, Orbit 4160 required three. Cell 12 has been loaded with dummy commands since Orbit 4523. Tick-Tock checks confirmed command execution at the erroneous times. No specific cause has been determined to explain the condition. Table 5-2 gives typical telemetry values.

Table 5-1. Summary of Cell 12 COMSTOR 'B' (Δ Time 256 Sec)

Orbit	Δ Time	Station
583	H	Bermuda
635	H	Alaska
891	H	Greenbelt
1225	H	Greenbelt
1254	H	Greenbelt
1538	H	Greenbelt
1696	L	Alaska
1699	H	Greenbelt
1719	H	Alaska
1803	L	Greenbelt
1852	L	Bermuda
1983	H	Alaska
2189	H	Goldstone
2739	NR	Greenbelt
2860	NR	Alaska
2898	NR	Greenbelt
3141	H	Alaska
3429	H	Greenbelt
3640	H	Alaska
3686	H	Alaska
3746	NR	Alaska
3760	L	Alaska
3790	L	Bermuda
3843	L	Alaska
3895	H	Greenbelt
4041	H	Carnarvon
4160	H	Greenbelt
4162	H	Goldstone
4523	H	Alaska

H - Δ time 256 seconds higher than entered.
L - Δ time 256 seconds lower than entered.
NR - Not Recorded

Table 5-2. Command/Clock Telemetry Summary

Function No.	Name	Mode	Units	* T/V Plateau 20°C	Orbit 35	Orbit 4300	Orbit 4700	Orbit 5099
8005	Pri. Power Supply Temp	-	°C	37.0	37.31	39.60	39.45	39.37
8006	Red. Power Supply Temp	-	°C	41.3	35.73	38.29	38.14	38.08
8007	Pri. Osc. Temp	-	°C	31.1	31.14	32.20	32.12	31.98
8008	Red. Osc. Temp	-	°C	30.3	30.47	31.42	31.41	31.39
8009	Pri. Osc. Output	-	TMV	1.07	0.95	0.96	0.96	0.96
8010	Red. Osc. Output	-	TMV	0.98	**	**	**	**
8011	100 kHz	Pri. - Red.	TMV	3.10	3.11	3.11	3.12	3.10
8012	10 kHz	Pri. - Red.	TMV	3.07	3.10	3.08	3.08	3.07
8013	2.5 kHz	Pri. - Red.	TMV	2.95	2.95	2.95	2.95	2.95
8014	400 Hz	Pri. - Red.	TMV	4.40	4.40	4.40	4.40	4.40
8015	Pri. +4V Power Supply	Pri. Clk ON	VDC	4.10	4.10	4.10	4.10	4.10
8016	Red. +4V Power Supply	Red. Clk ON	VDC	3.98	3.95	3.95	3.95	3.95
8017	Pri. +6V Power Supply	Pri. Clk ON	VDC	6.07	6.06	6.07	6.08	6.07
8018	Red. +6V Power Supply	Red. Clk ON	VDC	5.95	6.00	5.94	5.95	5.94
8019	Pri. -6V Power Supply	Pri. Clk ON	VDC	-6.02	-6.02	-6.02	-6.03	-6.02
8020	Red. -6V Power Supply	Red. Clk ON	VDC	-6.02	-5.99	-6.00	-6.00	-6.00
8021	Pri. -23V Power Supply	Pri. Clk ON	VDC	-22.96	-22.88	-22.89	-22.90	-22.89
8022	Red. -23V Power Supply	Red. Clk ON	VDC	-23.0	-22.98	-23.00	-23.01	-23.00
8023	Pri. -29V Power Supply	Pri. Clk ON	VDC	-29.2	-29.13	-29.15	-29.15	-29.16
8024	Red. -29V Power Supply	Red. Clk ON	VDC	-29.2	-29.07	-29.22	-29.22	-29.21
8101	CIU A -12V	CIU A ON	VDC	-12.3	-12.33	-12.33	-12.33	-12.33
8102	CIU B -12V	CIU B ON	VDC	-12.2	-12.26	-12.26	-12.25	-12.26
8103	CIU A -5V	CIU A ON	VDC	-5.34	-5.32	-5.34	-5.34	-5.34
8104	CIU B -5V	CIU B ON	VDC	-5.30	-5.31	-5.31	-5.31	-5.31
8105	CIU A Temp	CIU A ON	°C	24.3	24.47	24.98	24.98	24.77
8106	CIU B Temp	CIU B ON	°C	24.6	24.96	25.51	25.48	25.31
8201	Receiver RF-A Temp	-	°C	29.0	**	**	**	**
8202	Receiver RF-B Temp	-	°C	28.5	27.98	28.44	28.46	28.22
8203	D MOD A Temp	-	°C	37.5	25.41	25.90	25.88	25.73
8204	D MOD B Temp	-	°C	35.4	35.03	35.67	35.75	35.61
8205	Receiver A AGC	Receiver A ON	DBM	-70.0	**	**	**	**
8206	Receiver B AGC	Receiver B ON	DBM	-57.0	-94.74	-93.28	-88.35	-84.67
8207	Amp. A Output	Receiver A ON	RMV	1.50	**	**	**	**
8208	Amp B Output	Receiver B ON	TMV	1.54	2.81	2.89	3.03	3.22
8209	Freq. Shift Key A OUT	Receiver A ON	TMV	1.11	**	**	**	**
8210	Freq. Shift Key B OUT	Receiver B ON	TMV	1.10	1.10	1.11	1.10	1.11
8211	Amp. A Output	Receiver A ON	TMV	1.11	**	**	**	**
8212	Amp. B Output	Receiver B ON	TMV	1.13	1.13	1.13	1.13	1.13
8215	D MOD A -15V	Receiver A ON	TMV	4.98	**	**	**	**
8216	D MOD B -15V	Receiver B ON	TMV	4.99	5.00	5.00	5.00	5.00
8217	Regulator A -10V	Receiver A ON	TMV	5.39	**	**	**	**
8218	Regulator B - 10V	Receiver B ON	TMV	5.50	5.50	5.50	5.50	5.50

* Thermal Vacuum Test Data

** A component not used since prelaunch

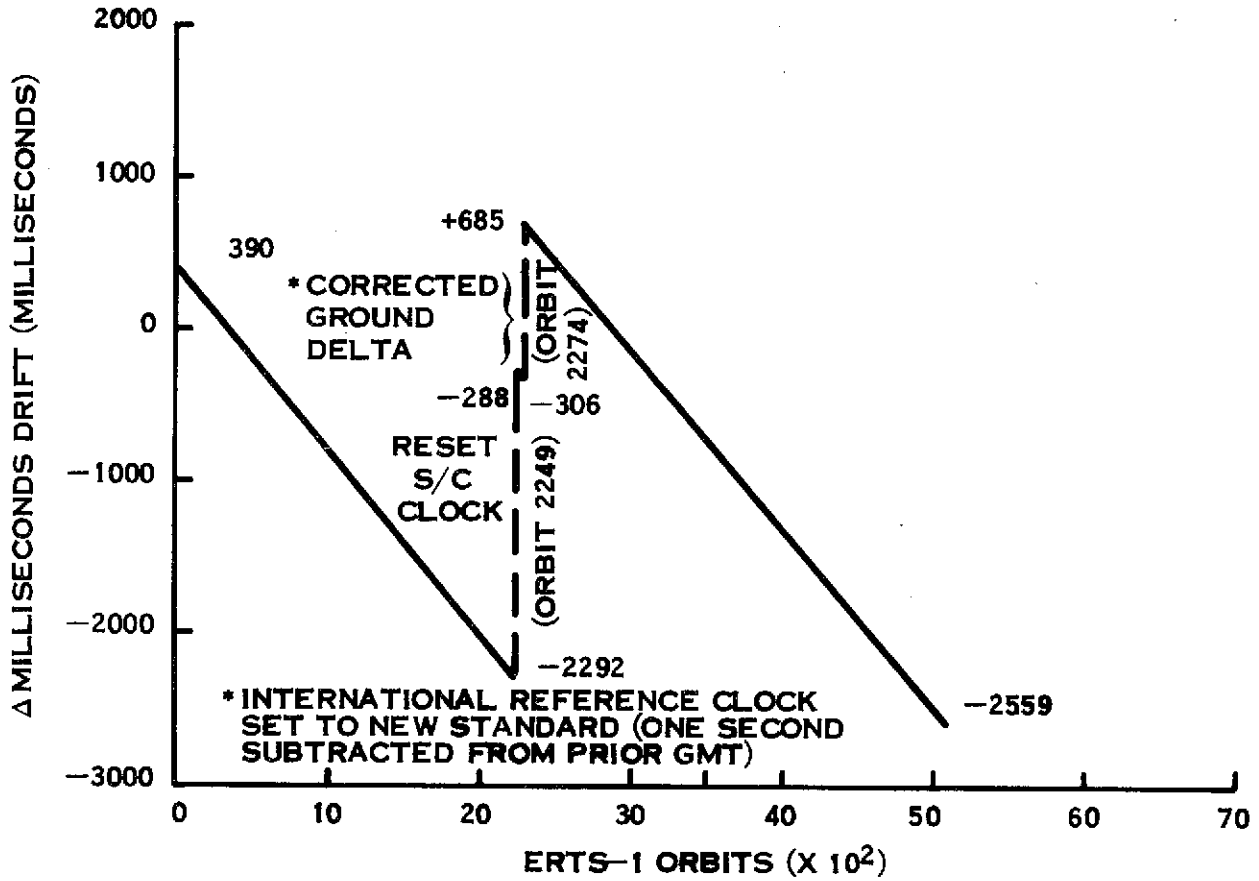


Figure 5-1. Command Clock Drift Summary

SECTION 6

TELEMETRY SUBSYSTEM

SECTION 6

TELEMETRY SUBSYSTEM

The Telemetry Subsystem was launched in the ON mode and has been operating continuously since then providing data from the spacecraft either to ground stations, the narrow band recorders, or both. Typical telemetry values are given in Table 6-1. Only memory Section 0.0 has been used in the telemetry matrix. Total performance has been excellent except for one integrated circuit chip failure, containing four functions (6012, 1011, 12238, 7010) in Orbit 4396. See PIR No. 1T23-ERTS-93 in Appendix B for detailed analysis.

Table 6-1. TLM Telemetry Summary

Function No.	Function Name	Unit	T/V* 20°C Plateau	Orbit 35	Orbit 4300	Orbit 4700	Orbit 5099
9001	Memory Sequencer A Converter	VDC	6.34	6.35	6.33	6.33	6.33
9002	Memory Sequencer B Converter	VDC	6.44	**	**	**	**
9003	Memory Sequencer Temp.	°C	20.1	19.59	20.83	20.29	21.06
9004	Formatter A Converter	VDC	5.99	5.99	5.99	5.99	5.99
9005	Formatter B Converter	VDC	6.02	**	**	**	**
9006	Dig. Mux A Converter	VDC	10.02	10.01	10.04	10.05	10.04
9007	Dig. Mux B Converter	VDC	10.01	**	**	**	**
9008	Formatter/Dig. Mux Temp.	°C	22.2	22.50	24.78	24.40	24.89
9009	Analog Mux A Converter	VDC	26.18	26.01	26.18	26.18	21.18
9010	Analog Mux B Converter	VDC	26.21	**	**	**	**
9011	A/D Converter A Voltage	VDC	10.00	10.00	10.06	10.06	10.07
9012	A/D Converter B Voltage	VDC	10.06	**	**	**	**
9013	Analog MUX A/D Converter	°C	26.7	25.00	25.83	25.62	26.83
9014	Preregulator A Voltage	VDC	19.91	19.93	19.95	19.96	19.95
9015	Preregulator B Voltage	VDC	19.88	**	**	**	**
9016	Reprogrammer Temp.	°C	19.9	22.0	22.41	22.01	22.50
9017	Memory A Converter	VDC	6.00	6.00	6.00	6.00	5.99
9018	Memory A Temp.	°C	19.3	17.51	17.45	17.41	17.50
9019	Memory B Converter	VDC	6.03	**	**	**	**
9020	Memory B Temp.	°C	17.4	17.68	17.44	17.42	17.63
9100	Reflected Power (Xmtr A)	dBm	0	11.95	12.32	12.25	12.32
9101	Xmtr A -20 VDC	VDC	-19.76	-19.75	-19.76	-19.78	-19.76
9102	Xmtr B -20 VDC	VDC	-19.79	**	**	**	**
9103	Xmtr A Temp.	°C	20.5	20.95	20.89	20.84	21.14
9104	Xmtr B Temp.	°C	20.0	21.69	21.64	21.61	21.95
9105	Xmtr A Power Output	dBm	25.48	25.12	25.36	25.36	25.35
9106	Xmtr B Power Output	dBm	25.84	**	**	**	**

* Thermal Vacuum Test Data
** Units not used since prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

SECTION 7
ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem has not been exercised during this report period. Table 7-1 is a summary of OAS performance to date and Table 7-2 gives average telemetry values for the off quiescent state. Subsystem status is nominal.

Table 7-1. Orbit Adjust Performance

Orbit	Burn Time (sec)	Average Sma (2) (KM)	Performance % of Plan	N_2H_4 Used # (3)
(1)	-	7281.461	-	-
38	4.8	7281.484	60.0	0.018
44	251.0	7283.456	103.5	0.934
59	318.0	7285.838	101.5	1.19
938	12.8	7285.877	110.0	0.044
2416	20.4	7285.877	106.0	0.076
	Average Force 0.81 LB_f			

(1) After Injection
(2) Semi-Major Axis
(3) Initial fuel load 67.0 pounds

Table 7-2. OAS Telemetry Values

Function No.	Name	Units	*T/V 20°C Plateau	Orbit			
				35	4300	4700	5099
2001	Prop. Tank Temp.	°C	18.2	22.03	22.86	22.45	22.86
2003	Thrust Chamber No. 1 (-x) Temp. (1)	°C	20.9	29.57	33.40	31.31	29.93
2004	Thrust Chamber No. 2 (+x) Temp. (1)	°C	19.7	38.76	39.54	38.77	40.28
2005	Thrust Chamber No. 3 (-y) Temp. (1)	°C	18.9	34.55	32.42	32.10	34.41
2006	Line Pressure	Psia	4.0	539.29	486.05	485.72	486.74

* Thermal Vacuum Test Data

(1) Wide spread of temperature due to nozzle locations and satellite day/night transitions relative to data averaged. Typical orbital range is from 19 to 59 DGC.

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The spacecraft was corrected for unbalanced magnetic moments in orbits 73, 85, 110 and 220. Adjustments were made in the pitch positive. The unit responded well as noted in Table 8-1 and has held its charge. The current dipole values are Pitch + 2950 Pole-Cm,roll zero, yaw zero. These values are unchanged since Orbit 220. Table 8-2 gives typical telemetry for the MMCA.

Table 8-1. MMCA Telemetry Before and After Adjustment

		Orbits							
Function	Units	72	75	83	88	106	115	218	224
4003	TMV	3.49	3.48	3.48	3.48	3.47	3.49	3.50	3.50
4004	TMV	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
	Pole-Cm	≈0	≈0	≈0	≈0	≈0	≈0	≈0	≈0
4005	TMV	3.13	2.87	2.87	2.77	2.77	2.65	2.65	2.52
	Pole-Cm	≈0	1200	1200	1800	1800	2350	2350	2950
4006	TMV	3.18	3.20	3.20	3.20	3.18	3.18	3.18	3.18
	Pole-Cm	≈0	≈0	≈0	≈0	≈0	≈0	≈0	≈0

Table 8-2. MMCA Telemetry Summary

			T/V 20°C*	Orbit			
Number	Name	Units	Plateau	35	4300	4700	5099
4001	A1 Board Temp	°C	19.8	19.77	19.25	19.04	19.03
4002	A2 Board Temp	°C	23.6	23.58	23.22	23.07	23.05
4003	Hall Current	TMV	3.50	3.48	3.48	3.48	3.48
4004	Yaw Flux Density	TMV	3.07	3.11	3.10	3.11	3.11
4005	Pitch Flux Density	TMV	3.12	3.13	2.51	2.52	2.51
4006	Roll Flux Density	TMV	3.22	3.19	3.19	3.19	3.19

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

SECTION 9

UNIFIED S-BAND PREMODULATION PROCESSOR

The Unified S-Band Subsystem has operated satisfactorily since launch.

The USB-A Receiver has been ON continuously since launch for a total of 8778 hours, available to any USB ground station for commands and ranging. Only Receiver A has been used to date.

The USB transmitter A has been QN for 1141 hours. It has been commanded on for transmission of telemetry and ranging data and for relay of DCS messages.

Table 9-1 lists telemetry values for orbits in this reporting period. All functions have maintained their prior values in this reporting period. Transmitter Power Output (Function 11002) which had decreased substantially in each reporting period, remained constant in this period. Its value is on the border between rounding off at 0.28 or 0.29 watts. One PCM count can shift the telemetered value either way. No effect on the functional operation of this transmitter is expected until the power output declines below 0.15 watts.

The history of the USB power output is shown in Figure 9-1.

In Figure 9-2, the AGC maximums, as recorded at the Goldstone ground station, are plotted as a function of time. Each point on Figure 9-2 is separated from adjacent points by 251 orbits (one cycle), thus permitting the same transmitting conditions of range, azimuth and elevation. The first orbit of one cycle retraces the earth track of the first orbit in the prior cycle.

The decibel drop in AGC level of both curves is 7 to 8 dB wgich corresponds closely to the 7.6 dB drop in USB power transmitted (from 1.6 watts to 0.29 watts).

Table 9-1. USB/PMP Telemetry Values

Function		Units	20°C Plateau	Orbit			
No.	Name		*TV	35	4300	4700	5099
11001	USB Revr. AGC	DBM	-127.24	-122.78	-127.72	-125.79	-131.39
11002	USB Trans. Pwr	WTS	1.60	1.60	0.29	0.28	0.29
11003	Receiver Error	KHZ	-24.33	-21.79	-21.50	-20.80	-21.32
11004	Transp. Temp.	DGC	20.37	22.92	22.78	22.82	22.64
11005	Transp. Pressure	PSI	15.68	15.91	15.92	15.92	15.91
11007	Trans A-15VDC	VDC	-15.16	-15.20	-15.20	-15.20	-15.20
11009	Ranging -15VDC	VDC	-14.76	-14.76	-14.76	-14.76	-14.76
11101	PMP A Volt	VDC	-15.21	-15.21	-15.14	-15.12	-15.18
11103	PMP A Temp.	DGC	23.14	30.44	30.25	30.47	30.23

*Thermal Vacuum Test Data; from EAB-FT-1 (unit changed to EAB-FT-2 for flight).

NOTE: Only "A" Unit has turned on.

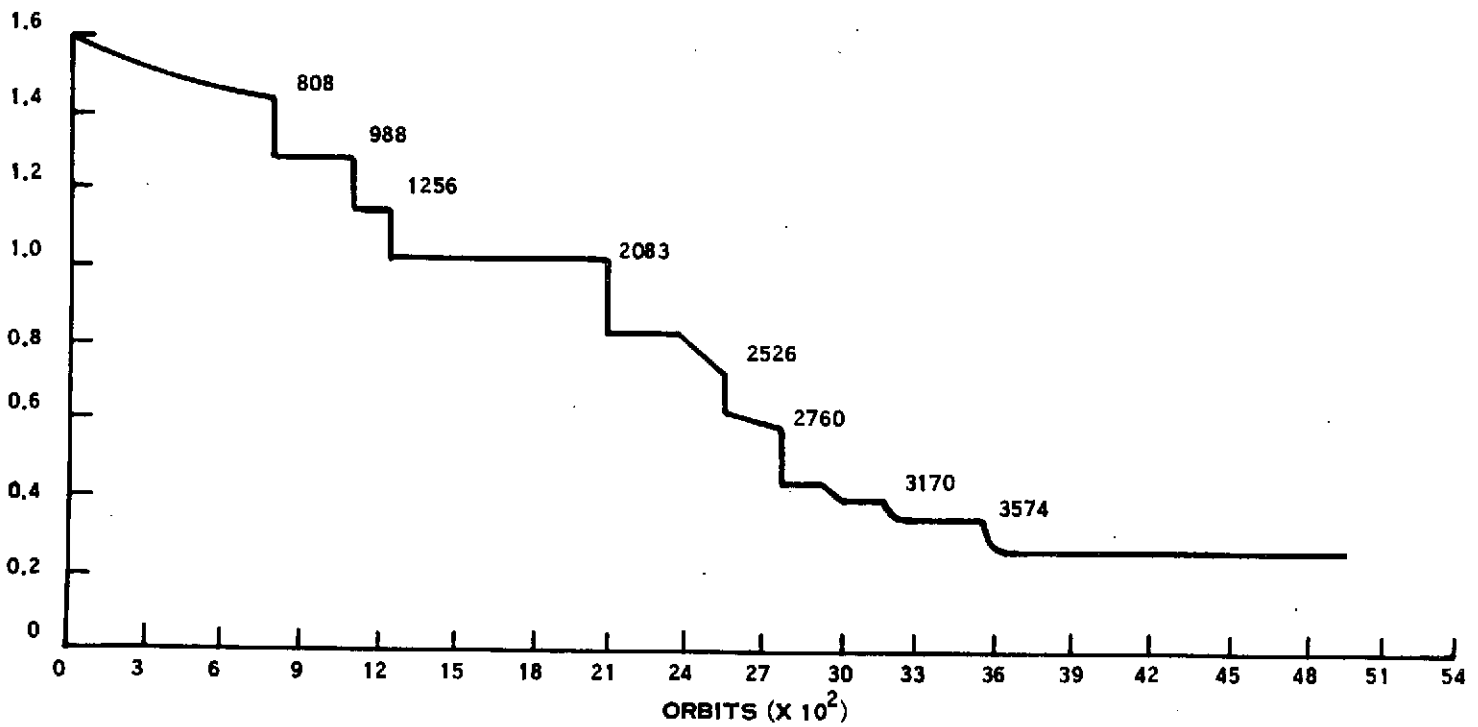


Figure 9-1. Power Output History of USB - A

NOTES:

1. DATA OBTAINED FROM PASS SUMMARY TTY MESSAGES
2. 85-FOOT ANTENNA USED DURING THIS PASS. AGC READING AT POINT WITHIN CIRCLE.

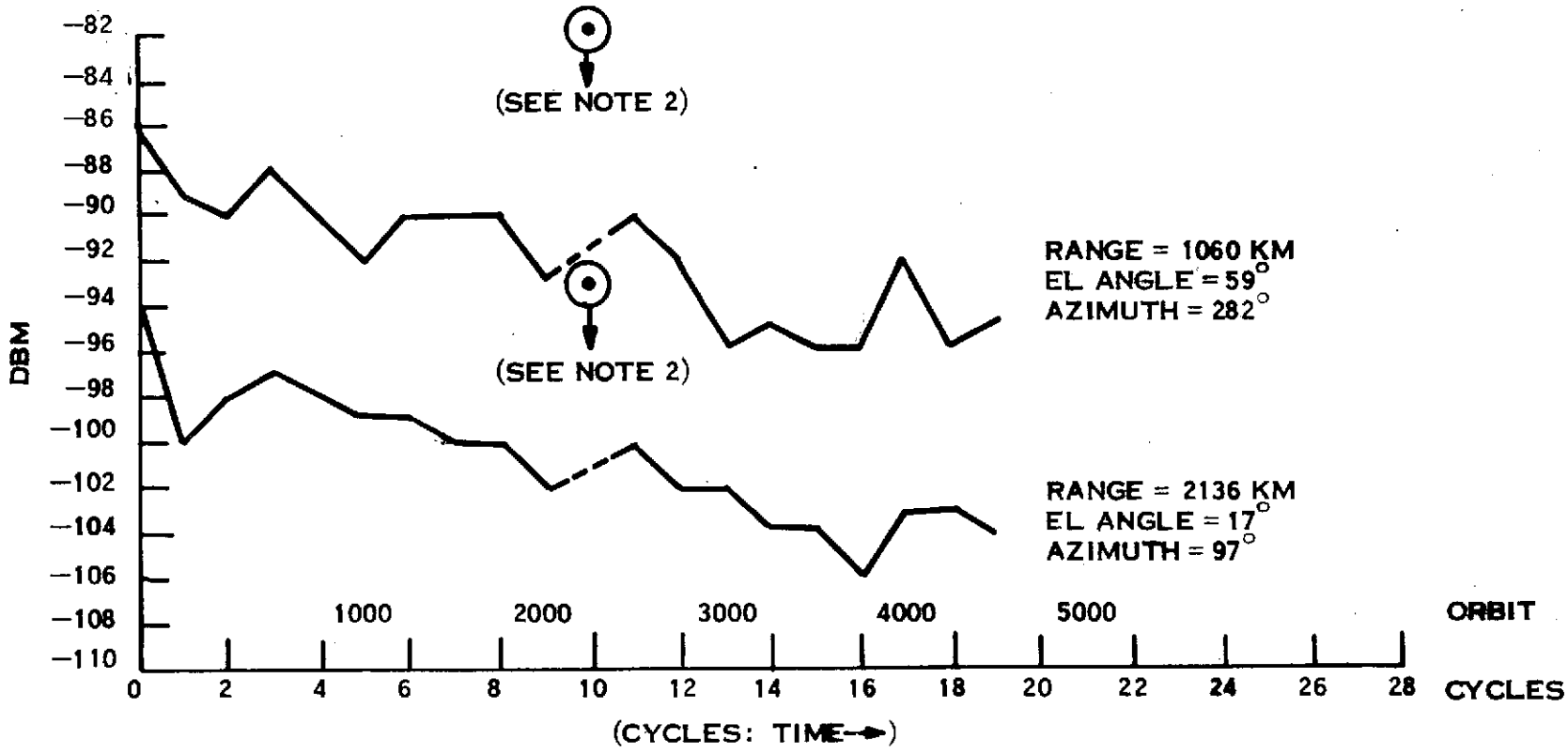


Figure 9-2. Goldstone AGC Readings on Link 4 with 30-Foot Antenna

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

Auxiliary Processing Unit (APU) consists of Search Track Data, Time Code Data, and Back-up Timers which operated satisfactorily throughout this report period. Telemetry for the APU is shown in Table 10-1. The APU is in Normal mode.

Table 10-1. APU Telemetry Functions

Functions	Description	Unit	Orbit 7	Orbit 4201	Orbit 4601	Orbit 5098
13200	APU, -24.5 VDC	VDC	24.90	24.90	24.91	24.90
13201	APU, -12 volts	VDC	12.08	12.08	12.08	12.08
13202	APU Temp.	DGC	25.49	26.87	26.61	26.95

The Power Switching Module (PSM) contains the switching relays for power to Orbit Adjust, MSS, WBVTR No. 1 and No. 2, RBV and PRM. The MSS and WBVTR No. 1 power circuits have been operated on a regular basis throughout this report period. The power relay for the RBV remained in a closed condition since orbit 196, but the RBV remained off by relays in the individual cameras and camera electronics. The WBVTR No. 2 remained off due to the failure occurring in orbit 148.

The Interface Switching Module (ISM) performed all switching normally during this report period. Compensation Loads changes were exercised in this report period.

SECTION 11

THERMAL SUBSYSTEM

SECTION 11

THERMAL SUBSYSTEM

The Thermal Subsystem has maintained spacecraft temperature control over a satisfactory range during this report period. Table 11-1 shows average analog telemetry values from data recorded on the NBTR. During this report period, the sun intensity decreased as shown in Figure 3-4 for day 114 to 205. The sun angle varied as shown in Figure 3-3.

The solar panel temperature and the sun sensor temperatures have maintained their same profile except that during this report period they have slightly decreased in maximum values due to the decreasing sun intensity, A plot of maximum solar panel temperatures and minimum solar panel temperature over the year is shown in Figure 11-1. This illustrates the seasonal sun angle and sun intensity variations.

During Orbit 4396, four telemetry gates mounted on one integrated circuit chip failed (see PIR-1T23-ERTS-93 in Appendix B). Function 7010, Temperature, Separator No. 7, Top Inboard began reading high. Its previous value was 19.8 degrees C which shifted to a varying value near 30 degrees C. The telemetry from this function is considered invalid.

Compensation load history is shown in Table 11-2. Compensation Load No. 3 was turned off in Orbit 4177 to allow better power management of the power system and to reduce the operating temperature range of the wideband recorder electronic unit No. 1. The operating temperature range over a full day's cycle of operation was 22 to 28^{o}C with compensation load No. 3 "ON" and 16 to 22^{o}C after the load was turned "OFF".

Table 11-1. Thermal Subsystem Analog Telemetry (Average Value for Frames of Data Received in NBTR Playback)

Function		Unit	Orbits						
Function No.	Description		26	1291	2600	3810	4201	4601	5098
7001	THM TH01 STI	DGC	19.52	21.47	22.18	21.05	20.70	20.54	20.85
7002	THM TH02 SBO	DGC	18.60	20.01	20.55	20.10	20.12	19.86	19.95
7003	THM TH03 STI	DGC	18.48	20.28	21.79	20.38	20.22	19.99	20.16
7004	THM TH03 SBI	DGC	19.47	20.46	21.11	20.29	20.48	20.36	20.25
7005	THM TH04 STI	DGC	18.39	19.81	21.17	20.03	20.04	19.91	19.71
7006	THM TH05 SBO	DGC	17.57	18.53	19.04	18.50	18.61	18.47	18.39
7007	OA -X THRUSTER	DGC	21.95	23.04	22.38	22.98	23.55	23.75	22.95
7008	THM TH07-STO	DGC	15.95	16.87	17.09	16.73	16.87	16.67	16.61
7009	THM TH06 SBI	DGC	19.38	20.62	21.05	20.53	20.62	20.42	20.35
7010	THM TH07 STI	DGC	18.61	19.71	19.79	19.56	19.75	*	*
7011	THM TH08 STO	DGC	21.78	22.87	22.52	22.84	26.70	23.29	22.77
7012	THM TH09 SBI	DGC	21.81	23.07	23.10	22.90	23.25	23.06	22.87
7013	THM TH10 SBO	DGC	18.73	19.82	19.87	19.58	19.94	20.08	19.53
7014	THM TH11 STI	DGC	22.37	23.62	24.52	23.42	23.47	23.23	23.35
7015	THM TH12 SBO	DGC	22.37	23.37	25.36	23.10	22.93	23.33	23.17
7016	THM TH13 STI	DGC	20.95	22.68	24.55	22.06	21.78	21.68	22.02
7017	RBV BEAM CTR LN	DGC	21.53	22.85	23.30	22.68	22.88	22.59	22.62
7018	THM TH14 STO	DGC	20.38	22.10	24.77	21.55	21.01	20.84	21.40
7019	NBR RAD OUTBD B4	DGC	5.09	6.08	6.06	5.93	6.24	5.92	5.86
7020	THM TH15 SBI	DGC	21.14	23.78	26.21	23.30	22.95	22.73	23.24
7021	THM TH16 STI	DGC	20.73	23.68	25.44	23.00	22.61	22.55	22.90
7022	THM TH17 SBI	DGC	20.22	23.46	25.18	22.68	22.52	22.30	22.76
7023	THM TH18 SBO	DGC	21.90	24.86	25.79	24.27	24.14	23.70	24.29
7030	THM TH03 BUR	DGC	16.05	17.09	17.89	17.25	17.36	17.29	17.07
7031	THM TH06 BUR	DGC	13.59	14.39	14.49	14.25	14.41	14.35	14.17
7032	THM TH09 BUR	DGC	19.92	20.89	20.61	20.76	21.18	21.30	20.75
7033	THM TH12 BUR	DGC	21.51	22.49	24.59	22.20	21.95	22.47	22.16
7034	THM TH15 BUR	DGC	19.70	22.44	24.36	21.80	21.21	20.83	21.67
7035	THM TH18 BUR	DGC	20.11	22.12	22.45	21.53	21.08	20.61	21.36
7040	THM TH01 TCB	DGC	19.27	20.80	21.58	20.64	20.43	20.23	20.46
7041	THM TH02 TCB	DGC	17.99	19.34	20.00	19.44	19.33	19.08	19.23
7042	THM TH03 TCB	DGC	18.34	19.72	21.83	20.44	20.42	20.51	19.94
7043	THM TH04 TCB	DGC	18.95	19.93	20.71	20.03	20.19	19.99	19.94
7044	THM TH05 TCB	DGC	16.27	17.13	17.45	17.07	17.22	16.92	16.98
7045	THM TH07 TCB	DGC	18.41	19.37	19.36	19.32	19.52	19.32	19.21
7046	THM TH09 TCB	DGC	19.38	20.60	20.52	20.34	20.77	20.62	20.37
7048	THM TH11 TCB	DGC	21.98	23.16	24.32	22.99	22.98	22.93	22.94
7049	THM TH12 TCB	DGC	21.92	22.58	25.10	22.30	22.04	22.45	22.46
7050	THM TH13 TCB	DGC	21.21	22.51	25.22	22.10	21.69	21.75	21.99
7051	THM TH14 TCB	DGC	21.38	23.65	26.19	22.92	22.52	22.32	22.88
7052	THM TH16 TCB	DGC	21.30	25.11	26.65	24.15	23.36	23.88	23.95
7053	THM TH17 TCB	DGC	21.73	24.81	25.74	24.01	23.93	23.60	24.03
7054	THM TH18 TCB	DGC	20.02	22.51	22.99	22.16	22.17	21.90	22.20
7060	THM SHUTTER BY 1	DEG	25.85	36.21	43.64	34.81	33.21	31.56	33.12
7061	THM SHUTTER BY 2	DEG	6.62	16.89	13.88	12.71	13.83	11.68	8.65
7062	THM SHUTTER BY 3	DEG	10.96	25.96	38.14	26.69	26.34	25.84	23.58
7063	THM SHUTTER BY 4	DEG	30.60	36.27	38.29	37.45	38.17	35.35	35.71
7064	THM SHUTTER BY 5	DEG	15.03	14.42	16.24	15.06	16.25	16.25	16.25
7065	THM SHUTTER BY 7	DEG	17.14	20.98	21.92	21.45	24.64	24.64	24.64
7067	THM SHUTTER BY 9	DEG	33.26	39.15	38.45	38.44	39.41	39.02	38.44
7068	THM SHUTTER BY 10	DEG	24.68	29.54	33.65	28.68	28.68	28.68	28.68
7069	THM SHUTTER BY 11	DEG	39.66	48.48	55.79	47.84	47.47	45.63	46.89
7070	THM SHUTTER BY 12	DEG	43.81	47.05	55.84	46.61	45.02	45.46	46.63
7071	THM SHUTTER BY 13	DEG	40.39	47.96	59.02	47.49	46.83	46.13	46.38
7072	THM SHUTTER BY 14	DEG	34.20	42.85	62.55	41.92	41.06	39.76	39.70
7073	THM SHUTTER BY 15	DEG	45.40	63.42	75.54	60.01	57.76	56.58	58.74
7074	THM SHUTTER BY 16	DEG	24.50	51.25	59.81	49.25	44.17	46.64	48.46
7075	THM SHUTTER BY 17	DEG	39.06	60.34	66.93	55.10	54.96	53.25	54.96
7076	THM SHUTTER BY 18	DEG	29.70	43.14	48.57	42.13	42.10	40.49	43.15
7080	THM Q1 T ZENER V	VDC	8.19	8.19	8.19	8.19	8.19	8.19	8.19
7081	THM Q2 T ZENER V	VDC	8.40	8.40	8.40	8.40	8.40	8.40	8.40
7082	THM Q3 T ZENER V	VDC	8.31	8.32	8.32	8.32	8.32	8.32	8.31
7083	THM Q1 S ZENER V	VDC	8.31	8.35	8.35	8.32	8.32	8.32	8.32
7084	THM Q2 S ZENER V	VDC	8.19	8.20	8.21	8.19	8.19	8.20	8.19
7085	THM Q3 S ZENER V	VDC	8.15	8.15	8.16	8.15	8.15	8.15	8.15
7090	THM PSM MOUNT	DGC	21.60	23.14	23.78	22.84	22.83	22.53	22.54
7091	THM IND ATTITUDE	DGC	19.40	20.69	21.07	20.66	20.76	20.15	20.42
7092	THM RBV RADIATOR	DGC	15.65	17.31	17.89	17.21	17.42	17.43	17.22
7093	THM RBVC CTR BM	DGC	20.30	21.81	22.49	21.67	21.88	21.54	21.61
7094	THM WBVTR ROOT	DGC	12.96	15.64	17.10	15.49	15.52	15.14	15.71
7095	THM WBVTR RAD CT	DGC	4.81	7.50	8.66	7.76	7.83	7.27	8.17
7096	THM WBVTR STRAP	DGC	16.62	19.39	21.06	19.02	19.05	18.64	19.32
7097	THM WB MT BAY 1	DGC	20.56	21.59	22.36	20.83	18.47	18.50	19.52
7098	THM WB MAT BAY 1	DGC	20.22	21.93	21.05	19.82	18.14	18.27	18.90
7099	THM WBVTR SEP 3	DGC	18.60	20.69	22.32	20.52	20.47	20.11	20.55
7100	THM WBVTR SEP 17	DGC	21.31	24.41	26.15	23.52	23.31	23.08	23.66
7101	THM WBVTR 1 DENT	DGC	21.49	24.19	25.95	23.43	23.33	22.97	23.72
7102	THM WBVTR 2 BAY	DGC	17.46	19.07	20.04	19.03	19.10	18.77	18.92
7103	THM WBVTR 2 BY 15	DGC	21.00	23.75	25.65	23.21	22.94	22.72	23.16
7104	THM WBVTR 2 CTR	DGC	19.35	21.86	23.50	21.38	21.33	20.91	21.51
7105	THM NBTR B SEP 6	DGC	18.06	19.71	20.17	19.52	19.72	19.29	19.30
7106	THM NBTR B SEP 1	DGC	20.82	22.89	24.88	22.47	22.18	21.94	22.35
7107	THM NBTR BM CTR	DGC	19.37	21.34	22.44	21.08	21.04	20.73	21.04
7108	THM MSS MOUNT 14	DGC	19.18	21.59	23.89	21.33	20.99	20.68	21.15
7109	THM OA -Y THRUSTER	DGC	22.21	24.85	28.11	24.17	23.36	23.14	23.80
7110	THM MSS WBVTR BM	DGC	18.14	20.27	21.29	20.21	20.29	19.84	20.06
7111	THM OA +X THRUSTER	DGC	20.30	21.82	23.43	20.80	19.34	19.45	19.92
7130	THM AVX P1 T	DGC	15.69	14.42	11.23	7.28	9.70	12.52	8.49
7131	THM AVX P2 T	DGC	10.63	19.10	3.63	20.36	16.68	9.80	1.59

* Function 7010 became invalid after an integrated circuit chip failure in the TMP on Orbit 4396.

FOLDOUT FRAME 2

Table 11-2. Compensation Load History

Compensation Load Changes								
ORBITS	1	2	3	4	5	6	7	8
Launch	0	0	0	0	0	0	0	0
2	0	0	x	x	x	0	x	x
6	x	x	x	x	x	0	x	x
118	0	0	0	0	0	0	0	0
156	x	x	x	x	x	0	x	x
194	0	0	0	0	0	0	0	0
197	x	x	x	x	x	0	x	x
701	x	x	0	x	x	0	x	x
1410	x	x	0	x	x	0	0	x
3484	x	x	x	x	x	0	0	x
3644	x	x	0	x	x	0	0	x
3646	x	x	x	x	x	0	0	x
4177	x	x	0	x	x	0	0	x

X = ON

0 = OFF

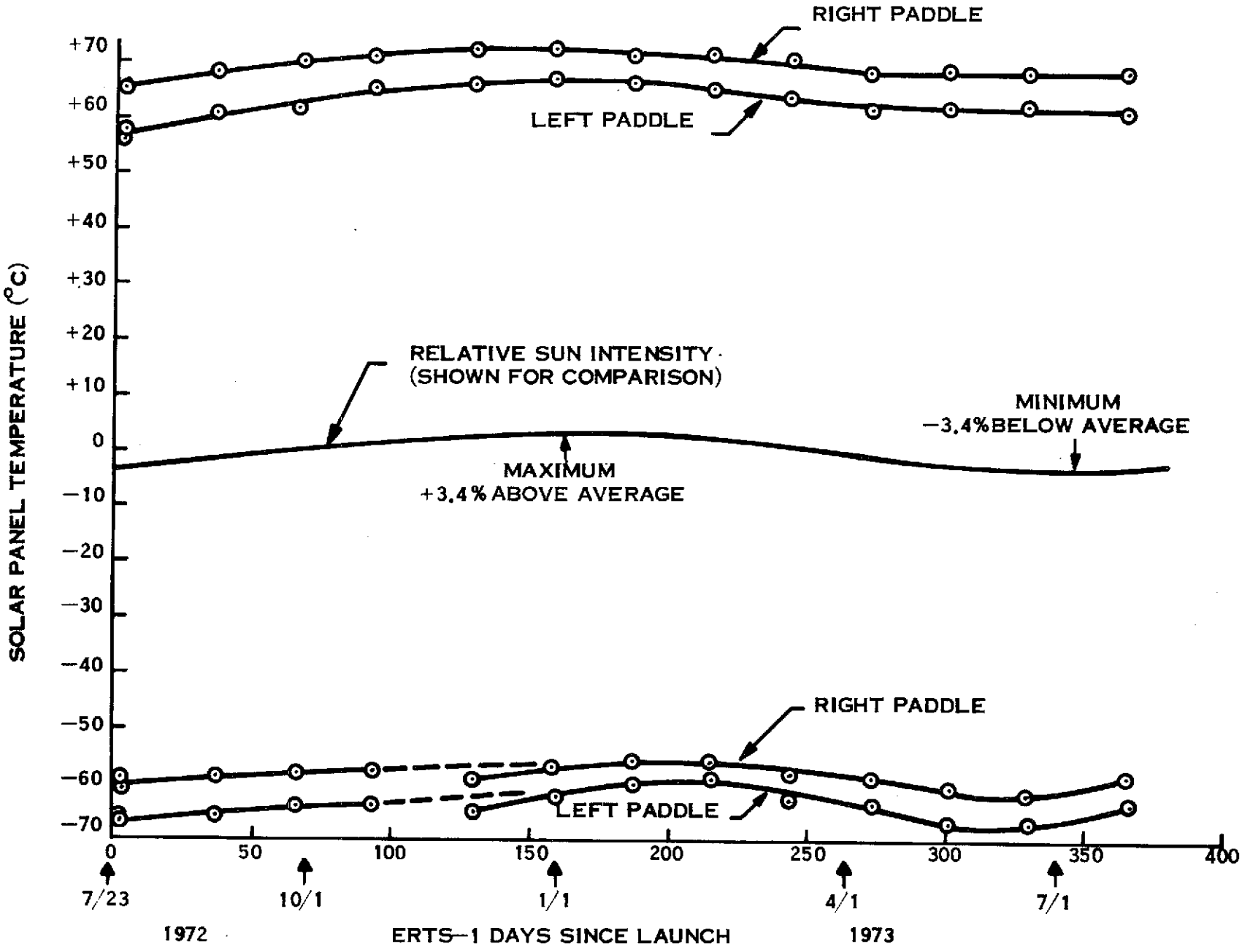


Figure 11-1. Solar Panel Maximum-Minimum Temperatures

SECTION 12

NARROWBAND TAPE RECORDERS

SECTION 12

NARROWBAND TAPE RECORDERS

The Narrowband Tape Recorder Subsystem continued to operate in a completely satisfactory manner. Since Orbit 1, the two recorders A & B have alternated in Record and Playback Modes with a nominal 1-minute overlap.

Since luanch, each recorder has had an ON time of 4473 hours. Each recorder was in the Playback Mode for 187 hours; in the Record Mode for 4286 hours and in the OFF mode for 4389 hours.

Table 12-1 shows telemetry values for two recent orbits. The values are nominal and are typical for all the orbits during this reporting period.

Figure 12-1 shows the history of the currents for the NBTR motors A & B and power supplies A & B.

The motor currents have remained practically level since launch. NBTR-B has always maintained a more constant value of current having a standard deviation of 1. The standard deviation of NBTR-A is 5, attributable to wider oscillations in the temperature cycling. A more detailed examination of these values may be seen in Figures 12-2 and 12-3 for the Orbits 4400-4600. In Figure 12-2 the motor currents for the Record Mode are shown as ◇ and + for Recorders A and B (or 1 and 2) respectively. It is seen that the currents for the recorders reveal a cyclic variation 180 degrees out of phase with their temperature cyclic variations shown above them as ⊙ and ⊡ respectively.

As shown in Figure 12-2, NBTR-A has higher temperatures than does NBTR-B. This is a result of the relative positions of NBTR-A and B on the spacecraft and the differential effects of exposure to the heating of the sun.

The detached scattered values for these currents shown in the lower portion of Figure 12-2 is caused by the software computations of 2 or 3 samples of the recorder just before it is turned off in the orbit and the recording role is assumed by the other tape recorder. Occasional zeros included after turn-off reduce the averages greatly, because of the small number of samples. Table 12-2 is a 5% sample showing the performance of the NBTR subsystem in its entirety, even including the radio downlink and the ground station processing. At the beginning of the table, there is a sample of values from early orbits for comparison.

The second and third columns show the percentage of bad data and missing data at the end of processing. The few high values are attributed to noise on the radio downlink.

The fourth column shows data rate, nominally 24 kilobits, reflecting the speed of the motor during playback. The slightly slower indicated motor speed has no effect on fidelity, but only increases the playback time by less than 1%.

The fifth column shows the standard deviation in the motor speed which would introduce "wow" and "flutter" effects in a major frame. The occasional high values are attributed to noise.

The last column identifies the recorder associated with poorer than normal data for that orbit. Since the two recorders share those orbits, it is concluded the anomalous data are due to noise and not to recorder malfunction.

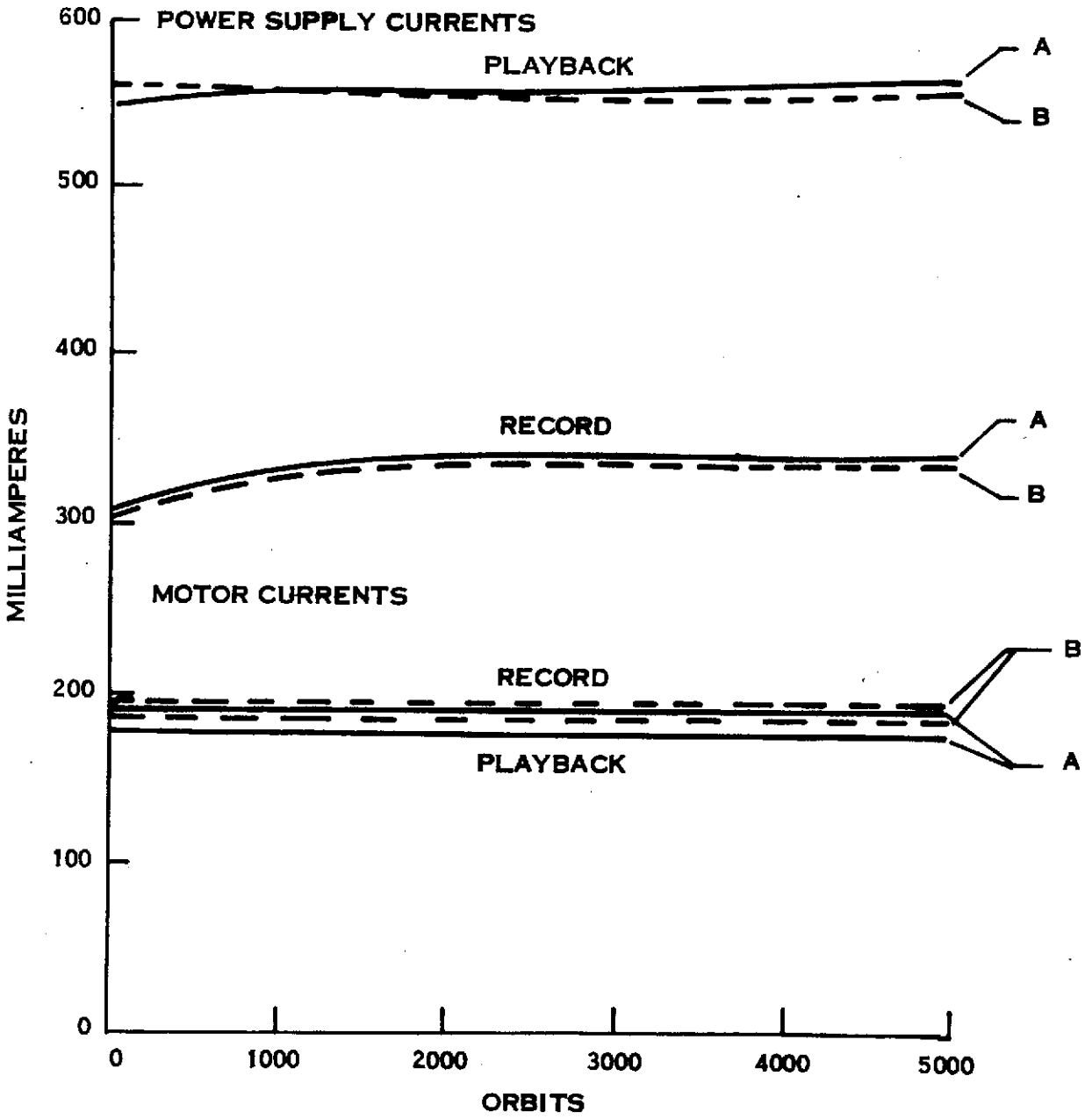


Figure 12-1. NBTR Currents

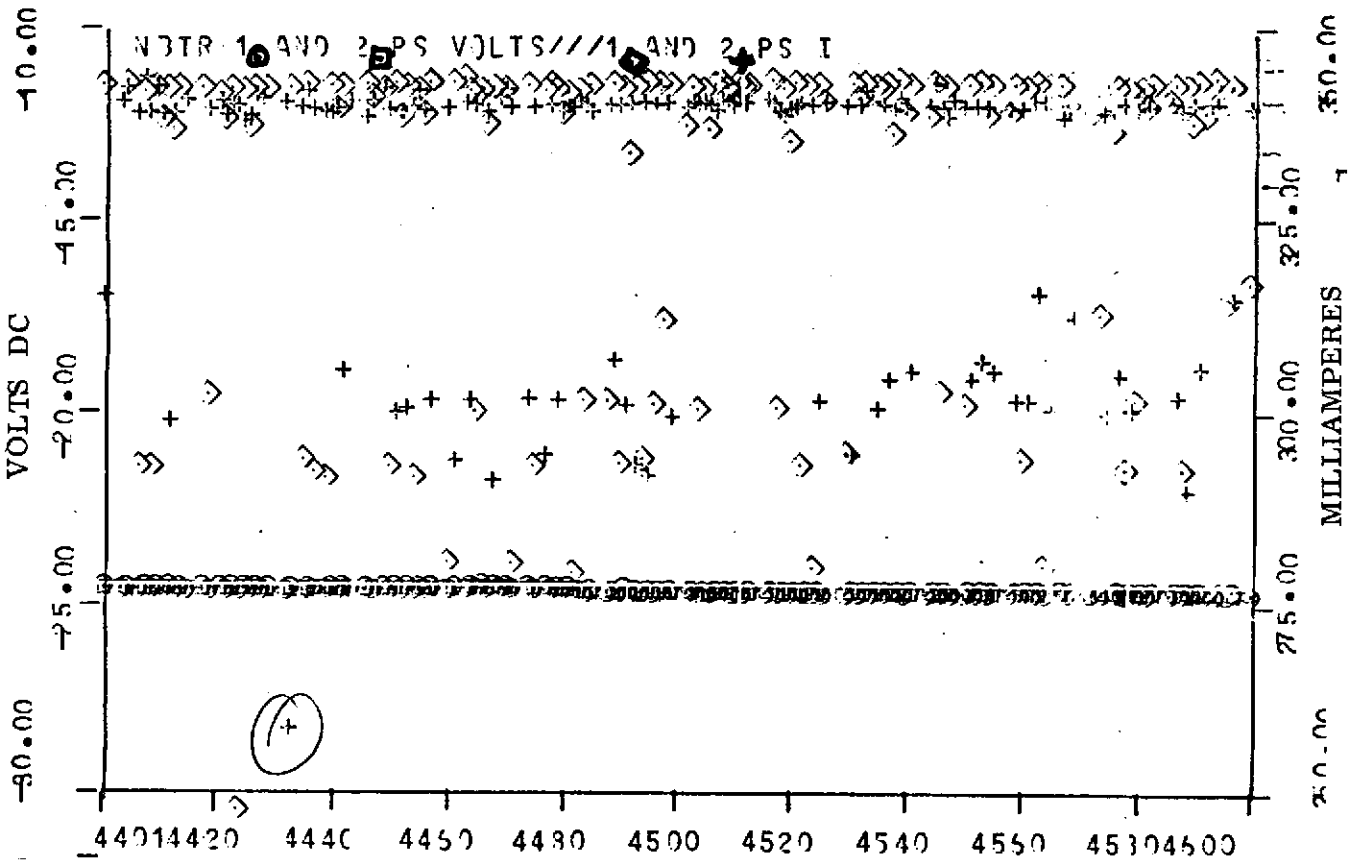


Figure 12-3. NBTR Volts DC

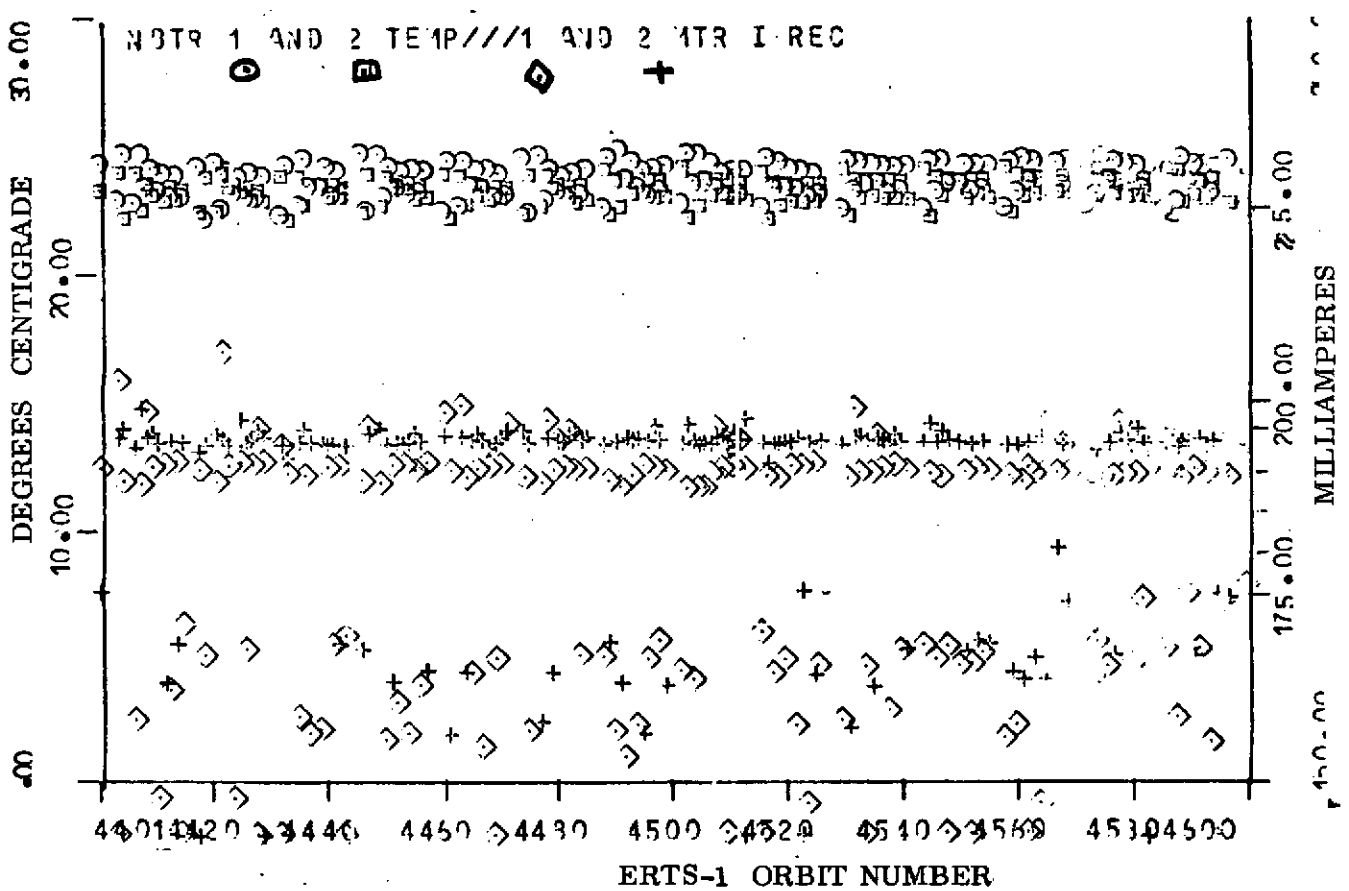


Figure 12-2. NBTR Degrees Centigrade

Note: Symbol /// indicates the functions to its right use the right hand vertical scale.

Table 12-1. Narrowband Tape Recorder Telemetry Values

Function		Thermal Vac Values	Typical Telemetry Values		
			Orbital Values		
Number	Name		6	4707	4708
10001	A - Motor Cur. (ma)				
	Record	198	190.10	190.3	
	P/B	185	180.00		175.5
10101	B - Motor Cur. (ma)				
	Record	194	193.26		195.3
	P/B	185	188.18	189.0	
10002	A - Pwr Sup. Cur. (ma)				
	Record	315	320.56	343.0	
	P/B	540	535.78		570
10102	B - Pwr Sup. Cur. (ma)				
	Record	313	317.62		340.2
	P/B	535	570.78	562.5	
10003	A - Rec. Temp. (DGC)	25.4	25.47	24.41	23.60
10103	B - Rec. Temp. (DGC)	23.8	24.58	22.97	23.80
10004	A - Supply (VDC)	-24.55	-24.47	-24.52	-24.61
10104	B - Supply (VDC)	-24.49	-24.44	-24.69	-24.57

Table 12-2. Narrowband Recorder Subsystem Performance

Orbit No.	% Data		Data Rate		RCDR
	Bad	Missing	Mean	Std. Dev.	
Sample of Prior Orbits					
953	0.00	0.00	-23.82	0.02	
1320	0.01	0.00	-23.82	0.03	
1495	0.00	0.00	-23.83	0.02	
1691	0.00	0.00	-23.84	0.03	
1897	0.31	0.00	-23.84	0.03	
2091	0.21	0.23	-23.85	0.57	A
2287	0.19	0.00	-23.85	0.54	A
2496	0.00	0.25	-23.85	0.60	A
3850	.00	.00	-23.86	.02	
1	.00	.00	-23.83	.02	
2	.00	.00	-23.86	.02	
3	.02	.00	-23.83	.02	
3854	.00	.00	-23.86	.02	
3950	.00	.00	-23.86	.02	
1	.01	.00	-23.83	.03	
2	.00	.26	-23.86	.02	A
3	.06	.24	-23.83	.02	B
3954	.00	.00	-23.86	.02	
4050	.83	.00	-23.86	1.08	B
4051	.83	.00	-23.86	1.08	A
2	.75	.26	-23.83	1.22	B
3	.51	.00	-23.86	.86	A
6	.00	.13	-23.85	.03	
4057	.06	.31	-23.87	2.00	A
4150	.25	.00	-23.83	.61	B
4	.01	.13	-23.85	.03	B
6	.00	.00	-23.87	.03	
7	.02	.00	-23.84	.02	
4158	.26	.00	-23.86	.61	
4251	.00	.18	-23.86	.02	A
2	.00	.13	-23.85	.03	B
3	.25	.00	-23.85	.59	A
4	.00	.00	-23.85	.02	
4255	.50	.00	-23.85	.87	A
4351	.01	.00	-23.84	.02	
2	.01	.00	-23.83	.02	
4355	.00	.00	-23.83	.02	
6	.23	.79	-23.83	2.60	B
4357	.01	.47	-23.84	.58	A
4450	.00	.00	-23.84	.02	B
1	.01	.00	-23.84	.02	A
2	.01	.00	-23.83	.02	B
4454	.00	.52	-23.83	.02	B
4455	.23	.00	-23.84	.59	A

Orbit No.	% Data		Data Rate		RCDR
	Bad	Missing	Mean	Std. Dev.	
4550	.00	.59	-23.83	.02	B
1	.00	.27	-23.84	.02	A
2	.70	.00	-23.84	57.13	
3	.01	.00	-23.84	.02	
4554	.00	.00	-23.83	.02	
4555	.01	.00	-23.85	.02	
4650	.23	.00	-23.89	.06	B
1	.00	.00	-23.85	.02	
2	.26	.00	-23.83	.61	
5	.00	.36	-23.85	.02	A
4656	.00	.51	-23.85	.03	B
4750	.06	.26	0.0	21.81	A
4753	.14	.44	-23.85	.46	B
4754	.00	.33	-23.86	.02	A
4757	.02	.00	-23.83	.02	
4759	.00	.00	-23.83	.02	

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has operated satisfactorily since initial turn-ON in Orbit 12. This subsystem consists of two independent and similar 10/20 watt S-band FM transmitters WPA-1 and 2 and associated filters, antennas and signal conditioning equipment. WPA No. 1 was used with RBV since initial turn-ON in Orbit 12 until the failure of the power input circuit to RBV in Orbit 196. Since that time, it was used with the MSS during the launch of Apollo 17 (Orbits 1891 to 2100) because its frequency was less likely to interfere with the Apollo operation. WPA-1 has had a total On-time of 31 hours, 55 minutes and 9 seconds, operating equally in the real time and in the playback modes.

WPA-2 was used with the MSS since its initial turn-ON in Orbit 12 in the 10-watt mode, and its change to 20-watts in Orbit 30. It has operated continuously since (except for the interval between Orbits 1891 and 2100 during Apollo 17 Launch).

WPA-2 has had a cumulative ON time of 575:18:48 operating 55% in the real time mode and 45% in the playback mode.

Table 13-1 gives the telemetry values for both of the Wideband Power Amplifier units. All values are normal and show no significant trends.

Figure 13-1 shows the AGC levels at ground station plotted as a function of slant range. Fifty (50) points early in the quarter and fifty-one (51) points late in the quarter are plotted together and intersperse indistinguishably.

Maximum signal occurs at a slant range of 1140 kilometers and a depression angle (measured at the spacecraft) of about fifty-two (52) degrees. At 2600 kilometers slant range the AGC level is 5 dB below the peak level. Due to the increased range alone, the expected drop in AGC level would have been about 7dB. The 2 dB gain can then be attributed to spacecraft antenna pattern.

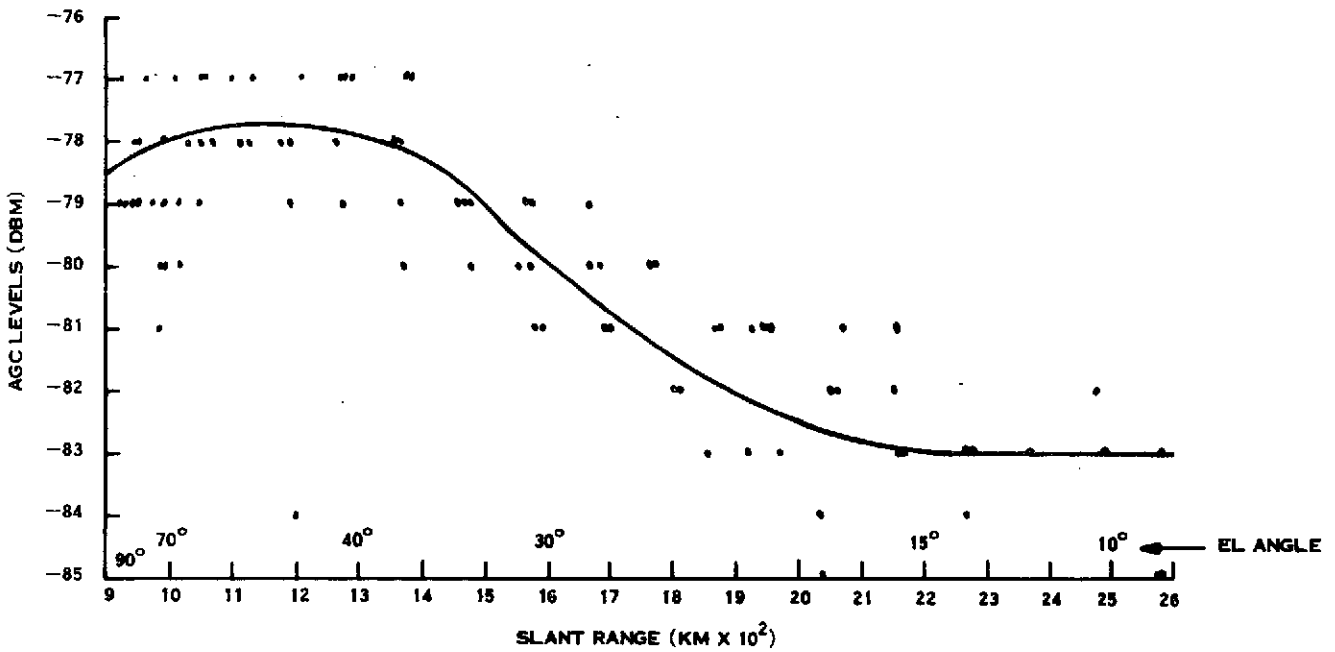


Figure 13-1. WPA Signal Strength vs Slant Range at Greenbelt

In Figure 13-2, signal strength is plotted against time since launch. To assure that each measurement is taken under similar transmission conditions of range, azimuth and elevation, related orbits were selected. Successive points on Figure 13-2 are separated by 251 orbits (which constitutes a cycle), when one orbit retraced the ground path of the prior orbit.

The two curves shown are for two similar families of orbits, at the slant ranges, elevation angles and azimuth angles shown. As can be seen, there is no decline in AGC levels with time. This corresponds to the values shown in Table 13-1 for function 12104 Forward Power which has remained at about 43 dBm (20 watts) since launch.

The AGC for two curves are separated by about 5 dB corresponding with the similar value drawn from Figure 13-1. The average values for the data on Figure 13-2 are about 3 dB above the values for those shown on Figure 13-1. This is due to the spacecraft antenna pattern, and to the differences in ground station equipment, alignment and calibration procedures.

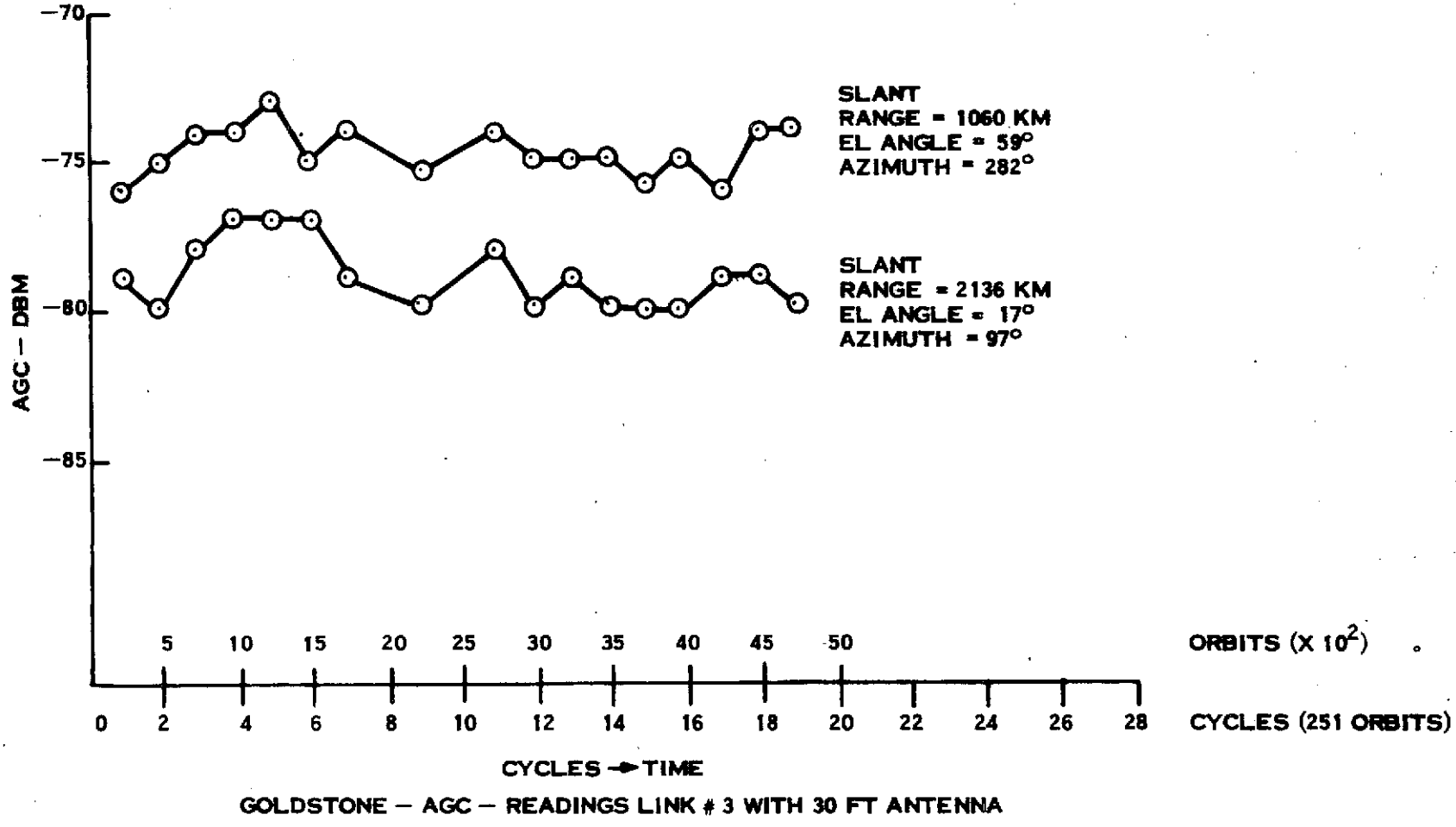


Figure 13-2. Goldstone AGC Readings Link No. 3 with 30-Foot Antenna

Table 13-1. Wideband Modulator Telemetry Values

WBPA-1

Number	Function Name		T/V* Values	ORBITS 26	1849	1944	2095
12001	Temp TWT Coll.	(DgC)	38.7	35.7	39.20	39.90	39.90
12002	Helix Current	(Ma)	6.47	6.08	6.49	6.58	6.78
12003	TWT Cath. Cur.	(Ma)	45.4	45.89	43.54	43.48	45.01
12004	Forward Pwr	(DBM)	43.2	43.18	42.88	42.61	43.15
12005	Reflected Pwr	(DBM)	32.4	34.95	34.99	34.80	35.21
12227	Loop Str. AFC Con Volt	(MHZ)	(1)	-0.39	-1.26	-0.86	-0.67
12229	Mod Temp VCO	(DgC)	24.4	21.93	20.31	20.88	20.39
12232	+15 VDC A(3) Pwr Sup (3)	(TMV)	2.69	2.69	2.69	2.65	2.62
12234	-15 VDC Pwr Sup A	(TMV)	5.91	5.98	5.96	5.73	5.78
12236	+5 VDC Pwr Sup A	(TMV)	4.01	3.94	3.94	3.94	3.95
12238	-5 VDC Pwr Sup A	(TMV)	5.26	5.28	5.26	5.18	5.12
12240	-24 VDC Unreg Volt A	(TMV)	5.42	5.56	5.51	5.42	5.49
12242	Inv. Temp	(DgC)	24.5	20.60	23.43	24.71	24.04

WBPA-2

Number	Function Name		T/V* Values(2)	ORBITS 33	3910	4461	4906
12101	Temp TWT Coll.	(DgC)	31.5	35.38	34.80	35.38	34.23
12102	Helix Current	(Ma)	5.26	7.32	7.65	7.55	7.70
12103	TWT Cath. Cur.	(Ma)	33.5	44.30	42.84	42.63	43.85
12104	Forward Pwr	(DBM)	41.2	43.57	43.54	43.38	43.57
12105	Reflected Pwr	(DBM)	30.6	31.59	33.10	32.45	32.99
12228	Loop Str HFC Con Volt	(MHZ)	(1)	1.11	-0.97	-0.55	-0.78
12229	Mod Temp VCO	(DgC)	24.4	21.70	22.07	22.53	20.88
12232	+15 VDC A(3) Pwr Sup	(TMV)	2.67	2.68	2.63	2.69	2.69
12234	-15 VDC Pwr Sup A	(TMV)	5.95	5.90	5.81	5.80	5.98
12236	+5 DC Pwr Sup A	(TMV)	4.01	3.97	3.97	3.95	4.01
12238	-5 VDC Pwr Sup A	(TMV)	5.26	5.24	5.16	3.30(4)	3.64(4)
12240	-24.5 VDC Unreg Volt A	(TMV)	5.42	5.43	5.47	5.52	5.52
12242	Inv. Temp	(DgC)	24.5	23.03	23.71	22.30	22.96

* Thermal Vacuum Test Data

(1)Any value other than 0.0 or -7.5 is satisfactory.

(2)Tested T/V in 10-watt mode; put in 20-watt mode in Orbit 30 and used in that mode since. Thermal vacuum values therefore are not representative for orbital operation.

(3)B Power Supply not used in orbit.

(4)This telemetry point became defective in Orbit 4396.

SECTION 14

ATTITUDE MEASUREMENT SENSOR

SECTION 14

ATTITUDE MEASUREMENT SENSOR

The AMS has consistently produced attitude values which seem reasonable. Since no direct precise correlation can be made with the Attitude Control System the AMS values are accepted. Effort is continuing to refine techniques to evaluate AMS performance. The AMS sensor is functioning properly and is actively used in MSS bulk processing of pictures.

Table 14-1 gives typical AMS telemetry values.

Table 14-1. AMS Temperature Telemetry Summary

Function No.	Name	Units	*T/V 20°C Plateau	Orbit			
				35	4300	4700	5099
3004	Case - Temp 1	°C	19.1	18.92	19.62	19.42	19.42
3005	Assembly - Temp 2	°C	18.9	19.15	19.93	19.67	19.76

*Thermal Vacuum Test Data

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

The Wideband Video Tape Recorder Subsystem consists of two components, WBVTR-1 and WBVTR-2. WBVTR-2 failed in Orbit 148 after 9 hours, 26 minutes and 33 seconds of satisfactory flight performance.

WBVTR-1 experienced an anomaly in Orbit 3463, as described in the last quarterly report, but otherwise has operated satisfactorily since turn-ON in Orbit 26. It operated with the RBV through Orbit 186 after which it was configured to operate with the MSS. Its cumulative ON time through Orbit 5100 is 629 hours, 11 minutes. Of this time, the video head was in contact with the moving tape for 497 hours, 03 minutes and 21 seconds. Combined with the pre-flight contact time of 126 hours, the total contact time has been 623:03:21.

Since Orbit 3800, only one period of higher-than-customary MFSE counts were experienced: between Orbits 4000 and 4200 (See Figure 15-1). Since that time, the MFSE counts have diminished to its early-life values of below 10. Since Orbit 4650, the average values have been below 5, and for the last 350 orbits, the average has been 3.

Throughout this reporting period, the head wheel motor current has remained between 540 and 600 milliamperes, near its early-life values of between 450 and 500 milliamperes. It is considerably below its anomalistic values of between 800 and 1000 milliamperes. Other telemetry values are shown in the typical readings shown in Table 15-1. For convenience and completeness, the telemetry values for WBVTR-2 is shown.

Some of the telemetry points have different values for different operating modes--Playback, Standby, Rewind and Record. These are shown in Table 15-2 for Orbit 4876. As can be seen, all values are normal.

Table 15-1. WBVTR Telemetry Values

WBVTR-1 Functions							
Number	Name		20 C Plateau T/V*	Telemetry Values in Orbits 15	3910	4876	5029
13022	Pressure Trans	(PSI)	16.3	16.12	16.11	16.08	16.11
13023	Temp Trans	(DgC)	22.0	19.50	21.94	21.37	21.84
13024	Temp Elec	(DgC)	28.7	22.78	25.68	19.48	20.44
13026	Capstan Speed	(%)	98.0	100.51	100.19	102.4	101.93
13027	Headwheel Speed	(%)	99.6	95.16	96.33	93.64	95.17
13028	Input P/B Volt.	(Amp)	0.24	0.25	0.27	0.26	0.27
13029	Rec Input I	(VVP)(2)	0.76	0.72	0.58	0.52	0.45
13030	Headwheel Mot I	(Amp)	0.55	0.55	0.57	0.56	0.54
13031	Rec Input I	(Amp)	3.55	3.15	3.74	3.67	3.68
13032	Lim Volt Out	(VPP)	1.48	1.44	1.46	1.45	1.45
13033	Servo Volt	(%)	50.0	50.03	50.63	50.78	50.74
13034	+5.6 VDC Conv	(VDC)	5.66	5.66	5.80	5.84	5.68
13200	-24.5 VDC	(VDC)	(1)	-24.91	-24.90	-24.90	-24.90
13201	-12 VDC	(VDC)	(1)	-12.08	-12.08	-12.08	-12.08
13202	Temp APU	(DgC)	(1)	25.79	27.05	26.97	26.70

WBVTR-2 Functions							
Number	Name		20 C Plateau T/V*	ORBIT NUMBER 15	64	103	147
13122	Pressure, Trans	(PSI)	(3)	15.99	16.25	16.25	16.11
13123	Temp Trans	(DgC)		18.46	19.19	20.72	21.09
13124	Temp Elec	(DgC)		21.50	22.00	24.00	21.92
13126	Capstan Speed	(%)		99.91	100.53	100.80	99.38
13127	Headwheel Speed	(%)		94.16	95.48	97.64	98.78
13128	Capstan Mot I	(Amp)		0.17	0.24	0.24	0.28
13129	Input P/B Volt.	(VPP)		0.66	0.63	0.62	0.61
13130	Headwheel Mot 1	(Amp)		0.55	0.59	0.52	0.53
13131	Rec Input	(Amp)		3.70	3.53	3.07	3.43
13132	Lim Volt. Out	(VPP)		1.34	1.41	1.41	1.39
13133	Servo Volt	(%)		49.47	49.60	49.80	49.48
13134	+5.6 VDC	(VDC)		5.47	5.64	5.58	5.59
13200	-24.5 VDC	(VDC)		-24.91	-24.90	-24.90	-24.90
13201	-12 VDC	(VDC)		-12.08	-12.08	-12.08	-12.09
13202	Temp APU	(DgC)		25.79	26.31	27.64	26.19

* Thermal Vacuum Test Data

(1) Thermal Vac Values not given

(2) After Orbit 196, WBVTR-1 configured to MSS: Thermal Vac Value then 0.40.

(3) Thermal Vacuum Data are not available for WBVTR-2.

Table 15-2. Function Values by Mode in Orbit 4876

Function/ Description	Playback		Standby		Rewind		Record	
	T/V	Orbit	T/V	Orbit	T/V	Orbit	T/V	Orbit
13029-Input P/B Voltage	0.37	0.53	0	0	0	0	0	0
13028-Capstan Motor Current	0.25	0.26	0	0	0.19	0.17	0.24	0.23
13030-Head Wheel Motor Current	0.54	0.56	0.43	0.44	0.45	0.45	0.55	0.58
13031-Recorder Input Current	3.27	3.67	2.04	1.73	2.16	1.89	3.55	3.40
13033-Servo Voltage	50.0	50.78	0	0	0	0	0	0

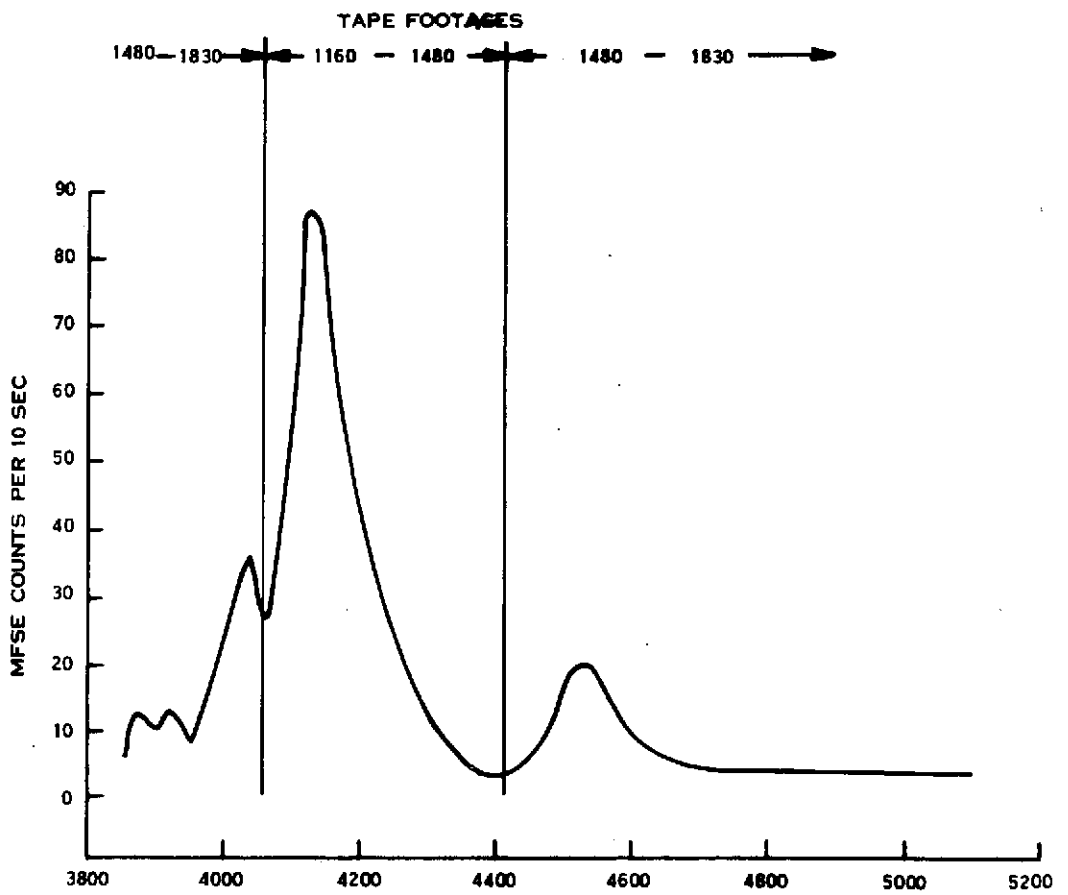


Figure 15-1. WBVTR-1 Average Minor Frame Sync Error Counts - Orbits 3810 - 5100

SECTION 16

RETURN BEAM VIDICON SYSTEM

SECTION 16

RETURN BEAM VIDICON

The Return Beam Vidicon (RBV) Subsystem operated normally from turn-on in Orbit 19 to Orbit 196 when it failed to respond to a turn-off command because of a probable failure of a relay in the Power Switching Module. The RBV itself was not the cause of the failure, nor was it affected by the failure. The RBV has not been reactivated since Orbit 196.

An assessment of the RBV performance was given in ERTS-1 Flight Evaluation Report 23 July to 23 October 1972. For completeness and convenience, the telemetry values are repeated in Table 16-1.

Table 16-1. RBV Telemetry Values

FUNCTION			ORBITS			
NO.	NAME	T/V VALUE	26	85	149	196
14001	CCC Board Temp. (DgC)	(1)	18.61	20.04	19.30	19.53
14002	CCC Pwr. Sup. Temp (DgC)	(1)	19.93	21.58	20.70	21.21
14003	±15 VDC Sup. (TMV)	3.95	3.69	3.95	3.78	3.95
14004	+6V-5.25 VDC Sup. (TMV)	3.05	2.84	2.93	2.98	3.05
14100	VID OUT CAM 1 (TMV)	1.06	1.04	1.15	1.13	1.12
14200	VID OUT CAM 2 (TMV)	1.09	1.05	1.26	1.23	1.24
14300	VID OUT CAM 3 (TMV)	1.05	1.03	1.21	1.19	1.20
14102	Comb. Align I Com 1 (TMV)	3.95	3.67	3.94	3.87	3.94
14202	Comb. Align I Com 2 (TMV)	3.92	3.90	3.91	3.89	3.91
14302	Comb. Align I Com 3 (TMV)	4.04	3.75	4.03	3.80	4.03
14103	Cam 1 Elec Temp. (DgC)	(1)	20.84	23.37	22.64	25.38
14203	Cam 2 Elec Temp. (DgC)	(1)	18.64	21.06	20.62	22.87
14303	Cam 3 Elec Temp. (DgC)	(1)	21.05	23.61	23.23	25.57
14104	Cam 1 LV Pwr Sup T. (DgC)	(1)	21.71	23.94	23.49	25.92
14204	Cam 2 LV Pwr Sup T. (DgC)	(1)	18.38	20.63	19.40	23.30
14304	Cam 3 LV Pwr Sup T. (DgC)	(1)	20.75	23.02	22.73	25.67
14105	Cam 1 Def. + 10 VDC (TMV)	4.01	3.73	4.00	3.77	4.00
14205	Cam 2 Def. + 10 VDC (TMV)	4.00	3.71	3.98	3.77	3.98
14305	Cam 3 Def. + 10 VDC (TMV)	3.97	3.95	3.95	4.02	3.95
14106	Cam 1 + 6V -6.3 VDC (TMV)	3.71	3.45	3.70	3.61	3.70
14206	Cam 2 + 6V -6.3 VDC (TMV)	3.69	3.42	3.67	3.49	3.67
14306	Cam 3 +6V -6.3 VDC (TMV)	3.73	3.47	3.72	3.47	3.72
14107	Cam 1 Telec I (TMV)	2.62	2.50	2.54	2.55	2.64
14207	Cam 2 Telec I (TMV)	2.65	2.53	2.56	2.41	2.64
14307	Cam 3 Telec I (TMV)	2.64	2.54	2.51	2.45	2.61
14108	Cam 1 Vid Fil I (TMV)	2.47	2.30	2.36	2.38	2.46
14208	Cam 2 Vid Fil I (TMV)	2.54	2.37	2.52	2.39	2.52
14308	Cam 3 Vid Fil I (TMV)	2.61	2.44	2.60	2.53	2.60
14110	Cam 1 TARVOLT (TMV)	3.43	3.42	3.42	3.45	3.42
14210	Cam 2 TARVOLT (TMV)	3.36	3.13	3.22	3.26	3.32
14310	Cam 3 TARVOLT (TMV)	3.47	3.23	3.46	3.45	3.47
14113	Cam 1 Vert Def V (TMV)	2.96	2.75	2.90	2.85	2.97
14213	Cam 2 Vert Def V (TMV)	3.00	2.86	2.98	2.86	3.01
14313	Cam 3 Vert Def V (TMV)	3.45	3.45	3.47	3.37	3.45
14114	Cam 1 Vid FPT (DgC)	(1)	18.15	20.77	17.91	20.99
14214	Cam 2 Vid FPT (DgC)	(1)	20.62	20.11	20.52	20.62
14314	Cam 3 Vid FPT (DgC)	(1)	18.54	20.88	19.08	20.20
14115	Cam 1 Foc Coil T (DgC)	(1)	17.71	21.67	18.74	19.70
14215	Cam 2 Foc Coil T (DgC)	(1)	17.70	21.60	19.25	19.97
14315	Cam 3 Foc Coil T (DgC)	(1)	18.03	22.09	19.88	20.56

(1) Thermo-Vacuum temperatures for these functions were not reported.

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem has operated satisfactorily since initial turn-On in Orbit 20. It has imaged 70,948 scenes from every continent, covering a total area of 618 million square nautical miles, more than ten times the area of the total land masses on earth.

Telemetry values have been normal since launch. Table 17-1 shows typical values. The maximum MUX temperature to date has been 31.15°C. The calibration lamp current has remained at 1.12 TMV from pre-launch to the present.

One hundred ninety-eight scenes per day on the average have been imaged since launch. Figures 17-1, 17-2, 17-3, 17-4 and 17-5 are computer-derived maps which show where and how many scenes were imaged at each geographic location. The orbits covered by these maps are shown on Table 17-2.

Along the right hand edge of these maps is listed the frame number - frame 1 being at the northern-most extreme of the earth ground trace; frame 61 being centered on the equator; and frame 120 being at the southernmost extreme of the earth ground trace. Thus, a definite latitude is associated with each of these numbers at the center of each frame.

Along the top of each figure are listed the numbers of the reference orbits associated with that vertical column. The land masses on the map are correspondingly shaped to conform. The continent outlines are sketched in roughly to assist in orientation of location of the frames.

The numbers in the vertical columns of the maps list the number of images taken of each geographic ground scene. The sum of the numbers in each ground scene for the five maps total the number of images made of that ground scene in the first year's operation.

Table 17-1. MSS Telemetry Values

Function No.	Name	Unit	T/V Val *	20	Orbit		
					3961	4461	5060
15044	FOPT 2 T	(DGC)	20.5	17.46	19.89	19.50	19.84
15046	ELEC CVR T	(DGC)	21.5	19.37	22.12	21.55	21.82
15048	SCAN MIR REG T	(DGC)	22.8	16.35	20.69	19.54	19.77
15050	SCAN MIR DR. COIL T	(DGC)	22.4	15.94	19.96	18.96	19.30
15052	ROT SHUT HSG T	(DGC)	20.8	16.91	19.98	19.66	20.07
15043	FOPT 1 T	(DGC)	20.6	17.67	20.05	19.69	20.01
15045	MUX PWR CASE T	(DGC)	22.4	21.19	24.21	22.34	22.03
15047	PWR SUP T	(DGC)	21.6	17.41	20.47	19.77	20.00
15049	SCAN MIR DR. ELC T	(DGC)	22.8	16.12	20.51	19.24	19.41
15051	SCAN MIR HSG T	(DGC)	21.1	15.60	19.46	18.62	19.05
15040	MUX -6 VDC	(TMV)	3.95	4.03	4.00	3.98	4.03
15042	AVG DENS DATA	(TMV)	1.76	1.67	2.39	2.08	2.13
15054	CAL LAMP CUR A	(TMV)	1.06	1.12	1.12	1.12	1.12
15056	BAND 2 ± 15 VDC	(TMV)	5.05	5.10	5.10	5.10	5.10
15058	BAND 4 ± 15 VDC	(TMV)	5.00	5.10	5.06§	5.04	5.10
15060	+12 - 6 VDC REG	(TMV)	4.90	4.82	4.99	4.90	5.02
15062	+19 VDC REC OUT	(TMV)	4.81	4.80	4.97	4.89	4.90
15064	BAND 1 HV A	(TMV)	5.21	5.10	5.13	5.12	5.16
15066	BAND 2 HV A	(TMV)	4.46	4.50	4.52	4.52	4.52
15068	BAND 3 HV A	(TMV)	4.58	4.60	4.63	4.63	4.62
15070	SHUT MOT CON OUT	(TMV)	2.46	2.43	2.49	2.45	2.44
15041	A/D CONV REF V	(TMV)	5.82	5.93	5.89	5.78	5.93
15053	SCAN MIR REG V	(TMV)	4.44	4.42	4.58	4.51	4.51
15055	BAND 1 ± 15V	(TMV)	4.94	4.97	4.98	4.97	4.97
15057	BAND 3 ± 15V	(TMV)	4.94	5.00	5.00	4.94	5.00
15059	-15 VDC TEL.	(TMV)	5.02	5.02	5.02	5.02	5.02
15061	±5 VDC LOGIC REG	(TMV)	4.80	4.82	4.76	4.80	4.81
15063	-19 VDC REG OUT	(TMV)	3.42	3.43	3.54	3.48	3.39
15071	SCAN MIR DR. CLK	(TMV)	1.94	1.93	1.99	1.95	1.97

* THERMAL VACUUM TEST DATA

(HV SUPPLY B NOT USED YET IN ORBIT)

Table 17-2. Computer Map Coverage

Quarter	Orbits
0	Launch through 115
1	116 through 1370
2	1371 through 2625
3	2626 through 3880
4	3881 through 5101*
	* The fourth quarter actually ends with Orbit 5135.

Time Code extracted from demuxed data was observed and found to be normal.

Post Pass Summary messages from the three U.S. MSS receiving stations are examined after every orbit. These show normal operation.

Tape screening sheets at the OCC are reviewed, and show normal operation.

Real time data is observed daily via A-scope, for all the video channels. Data quality appears to be excellent.

The line length, nominally 3220 words, is periodically printed out in computer runs. The data since launch is shown in Figure 17-6. Because of the slight decrease in length shown (0.01%), a few observations were made from the RSE lights for recent orbits. These are shown in Figure 17-7. The vertical lines on this figure for each orbit show the beginning (top) and end (bottom) line length during each orbit. The time-duration weighted averages for each orbit are connected to show the trend.

Minor Frame Sync error counts have been uniformly zero during real-time transmissions except at OCC where the long line connecting the receiving site and OCC occasionally results in counts of up to 8.

Noise characteristics at black level video exhibited no excessive noise in any of the 24 video channels.

Figures 17-8 through 17-15 show a cal wedge word quantum level history. Although only one word from the calibration wedge in each sensor has been selected for presentation in these figures, the other five words selected in the computer program to determine the wedge shaping have been analyzed and found to be consistent with the data presented herein.

All band 1 calibration wedges are still below saturation, but continue to remain stable.

Rotating shutter lock time was checked and found to be normal - a nominal 35 to 40 seconds.

Sun calibrations are currently performed every two weeks (about 200 orbits). Since launch, they have been performed in the 45 orbits shown in Table 17-3.

Table 17-3. Sun Calibration Orbits

21	1012	2278	4161
47	1207	2375	4370
89	1303	2389	4537
103	1400	2473	4705
131	1497	2585	4900
214	1595	2668	5095
326	1692	2766	
423	1790	2964	
521	1887	3159	
619	1985	3351	
730	2082	3543	
814	2166	3742	
915	2180	3938	

The Sun Cal input is obtained through a 4-faceted mirror of which 1 or 2 facets may be activated by the sun during a sun cal, depending on the spacecraft attitude, attitude rates and time of year. With a stable vehicle (nadir reference) the pulse duration may be about

9.3 seconds with the second pulse (if present) following in about 1 minute 11 seconds.

In Figure 17-16, the peak sun cal pulses observed are shown for three recent orbits. These may be compared with the values expected before launch:

Band 1	2.8 volts
Band 2	3.0 volts
Band 3	2.6 volts
Band 4	2.0 volts

It can be seen that all values are below the pre-launch expected values, but all flight values have consistently shown this difference, and there has been no significant change since launch.

Figures 17-17 and 17-18 show the history of sun calibration pulses for the averages in each of the four bands. Post Pass Summaries report the value in sensor 8 (band 2).

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

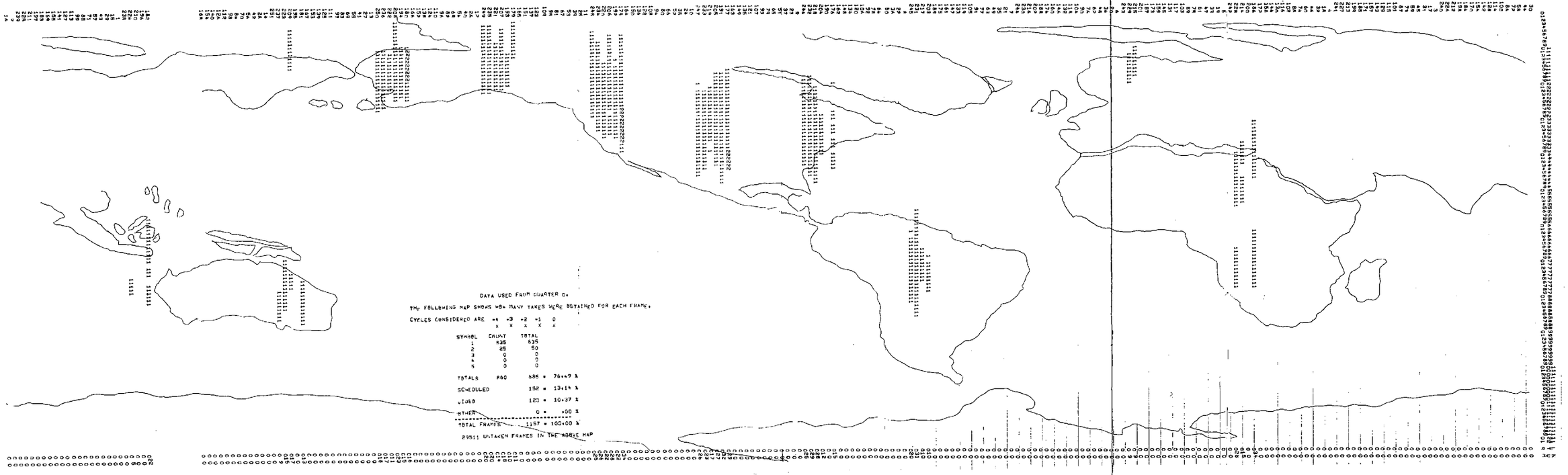


Figure 17-1 MSS Computer Map - Data Used from Quarter 0

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

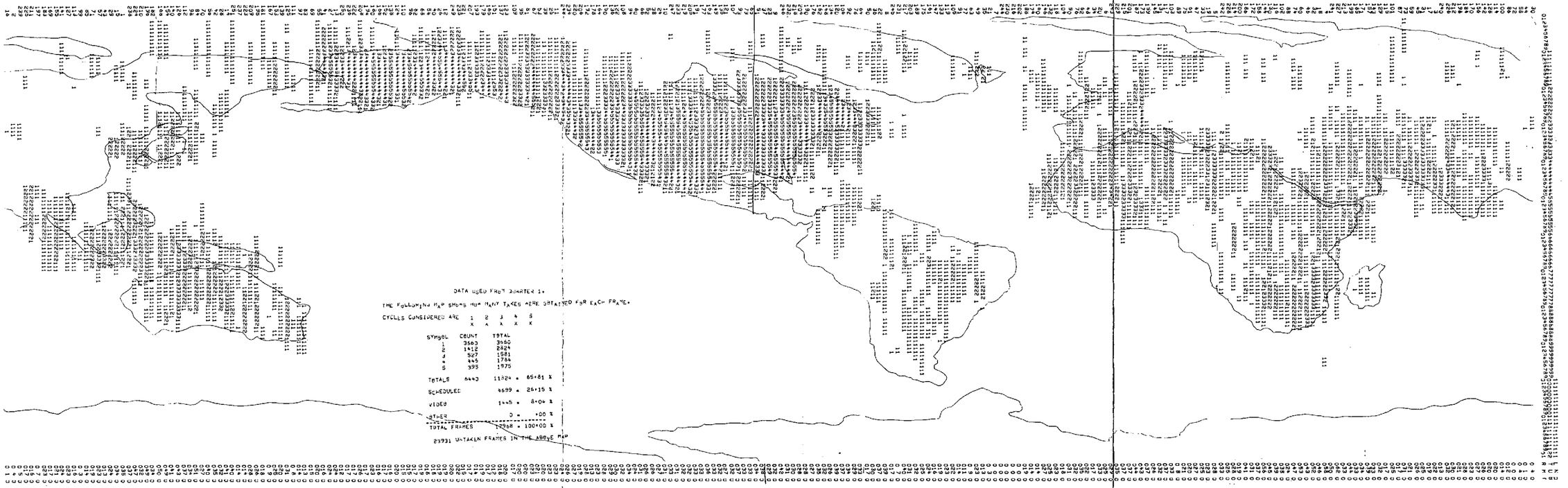


Figure 17-2. MSS Computer Map - Data Used from Quarter 1

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

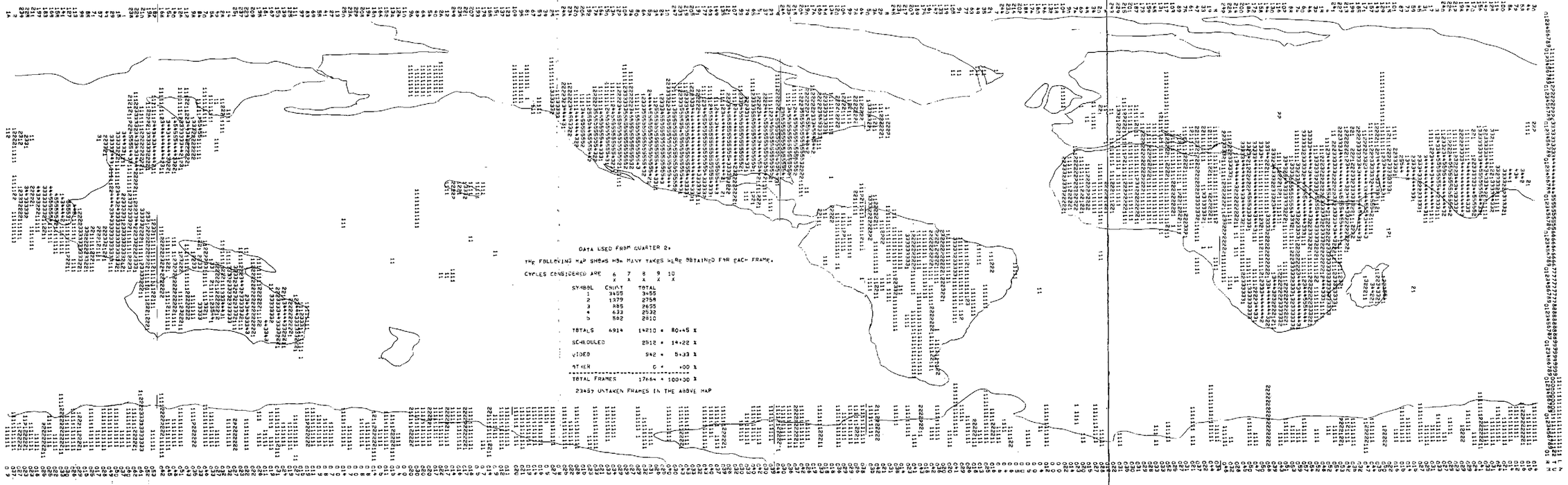


Figure 17-3. MSS Computer Map - Data Used from Quarter 2

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

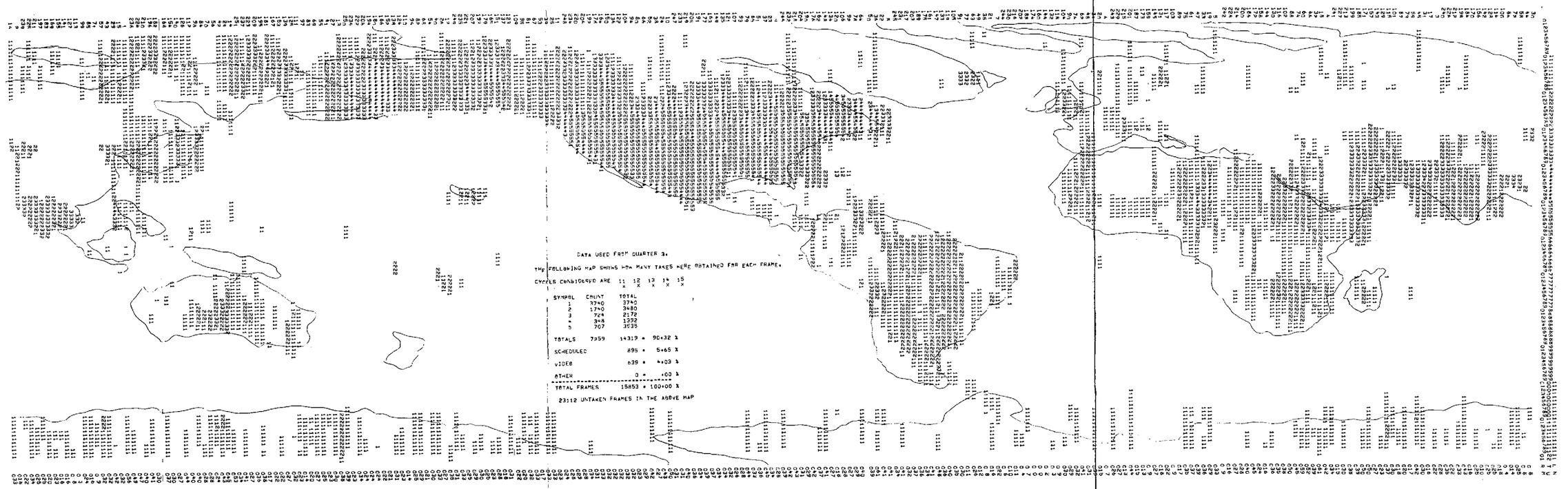


Figure 17-4. MSS Computer Map - Data Used from Quarter 3

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

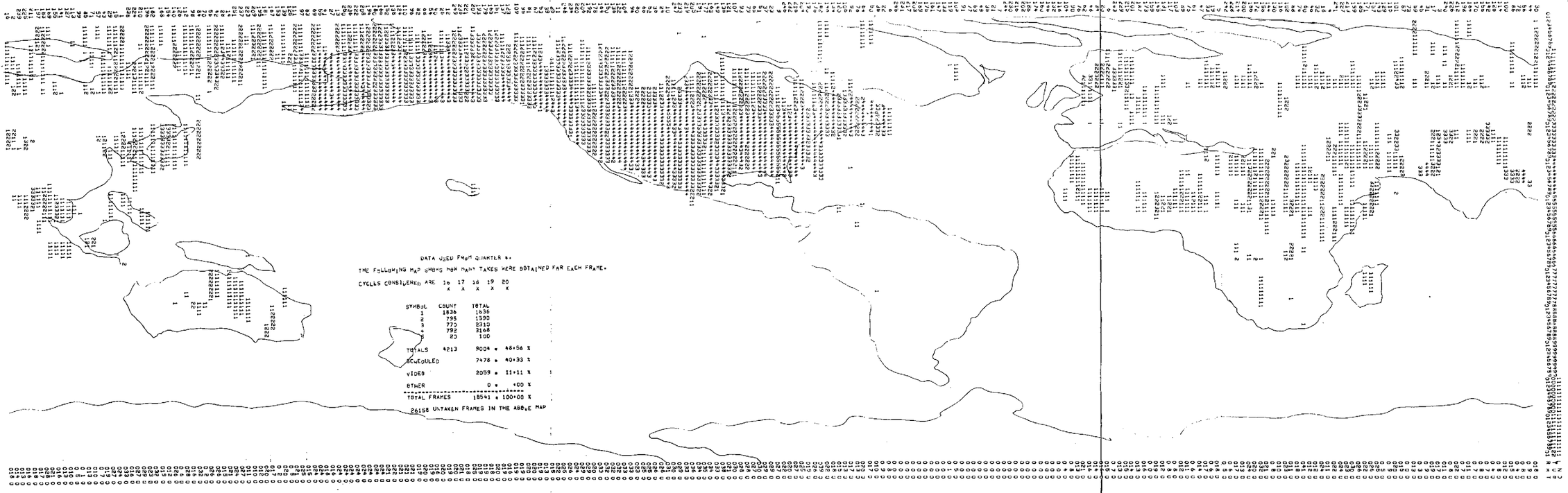


Figure 17-5. MSS Computer Map - Data Used from Quarter 4

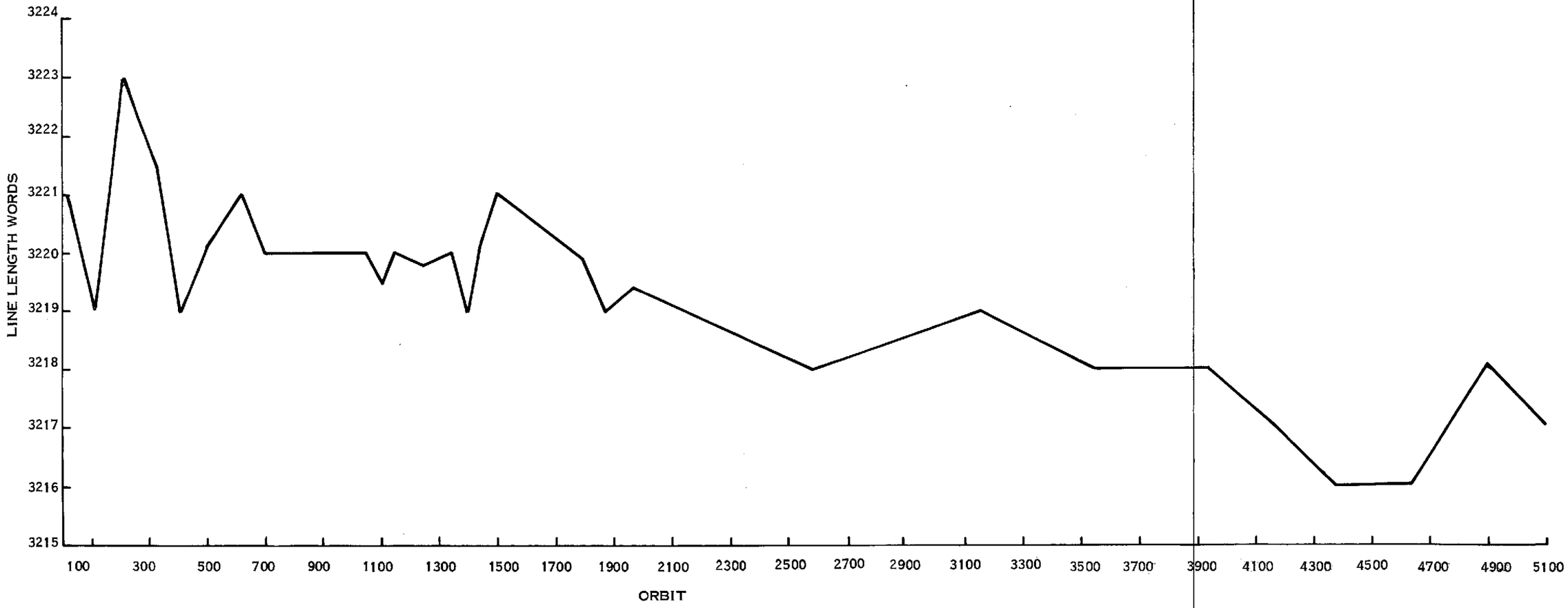


Figure 17-6. Line Length vs. Orbit

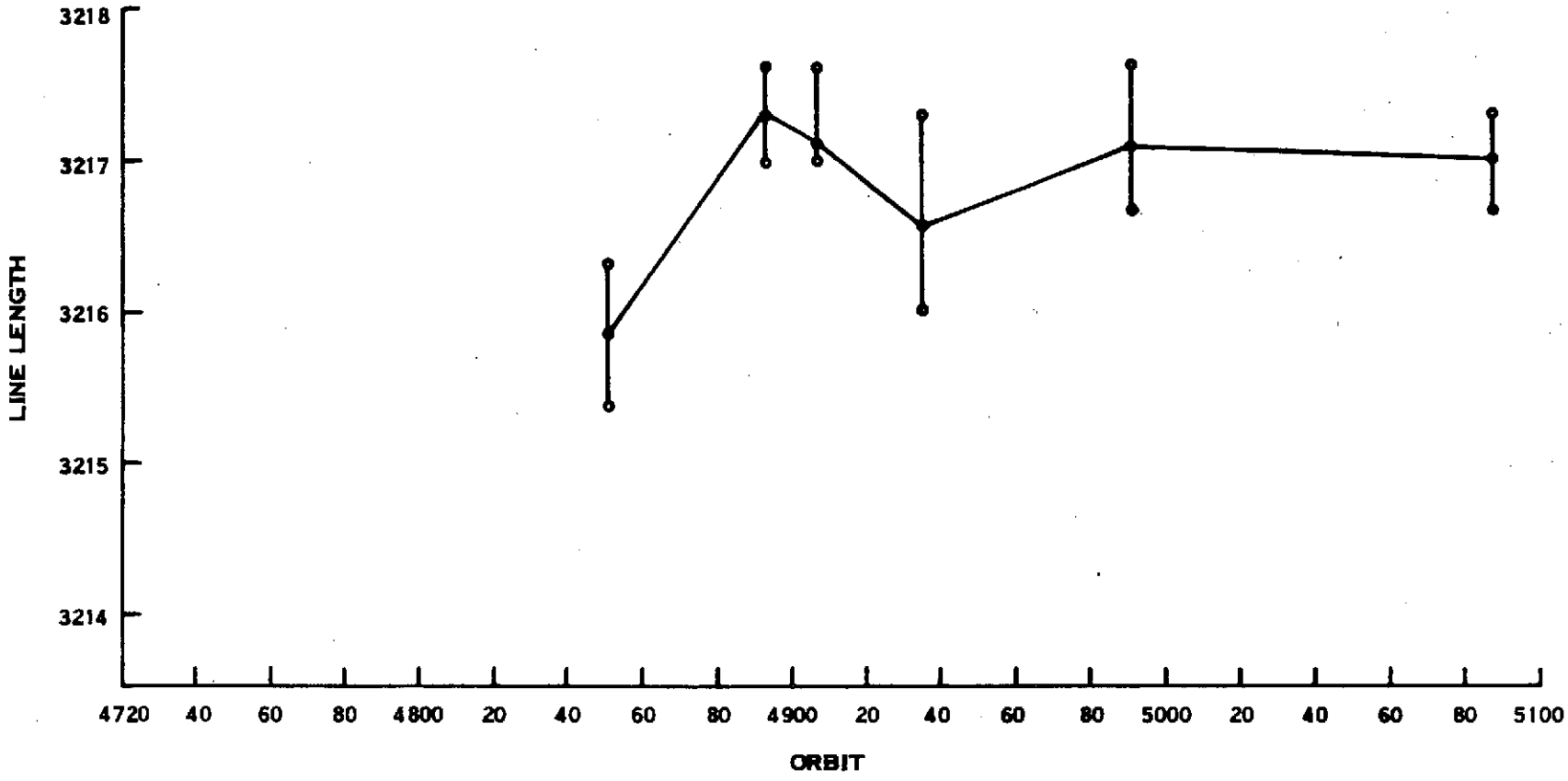


Figure 17-7. MSS Line Length from RSE Lights

FOLDOUT FRAME 1

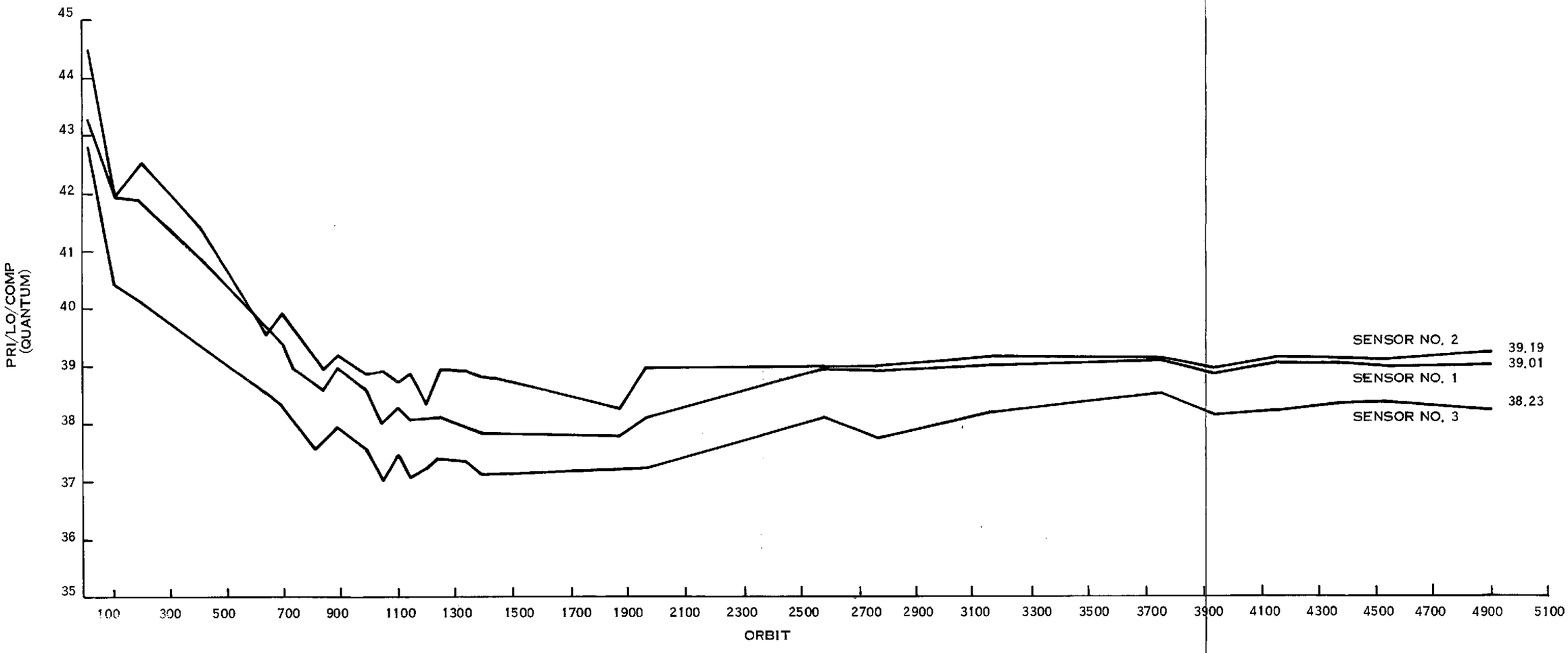


Figure 17-8. Band #1 Quantum vs. Orbit - Word #300

FOLDOUT FRAME 2

FOLDOUT FRAME 3

FOLDOUT FRAME 2

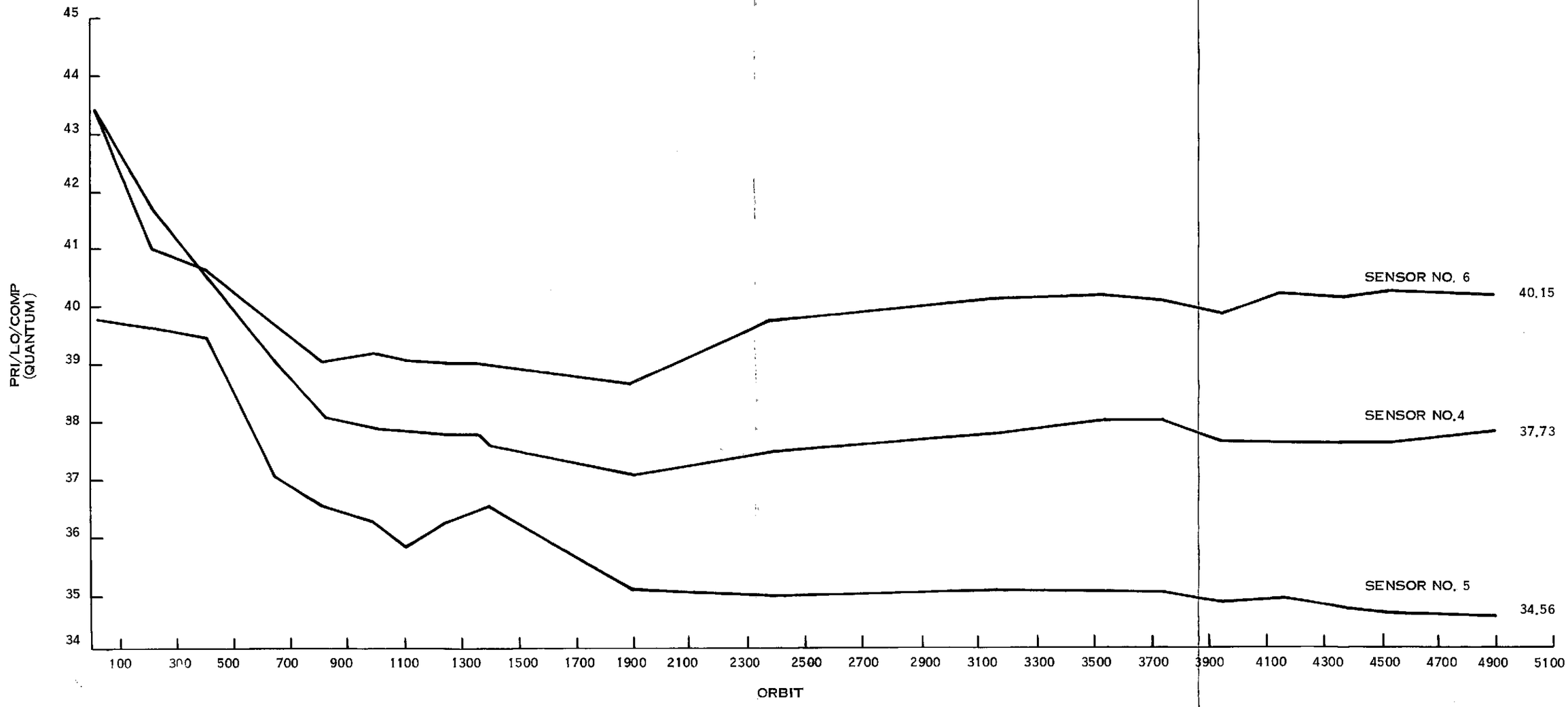


Figure 17-9. Band #1 Quantum vs. Orbit - Word #300

FOLDOUT FRAME 1

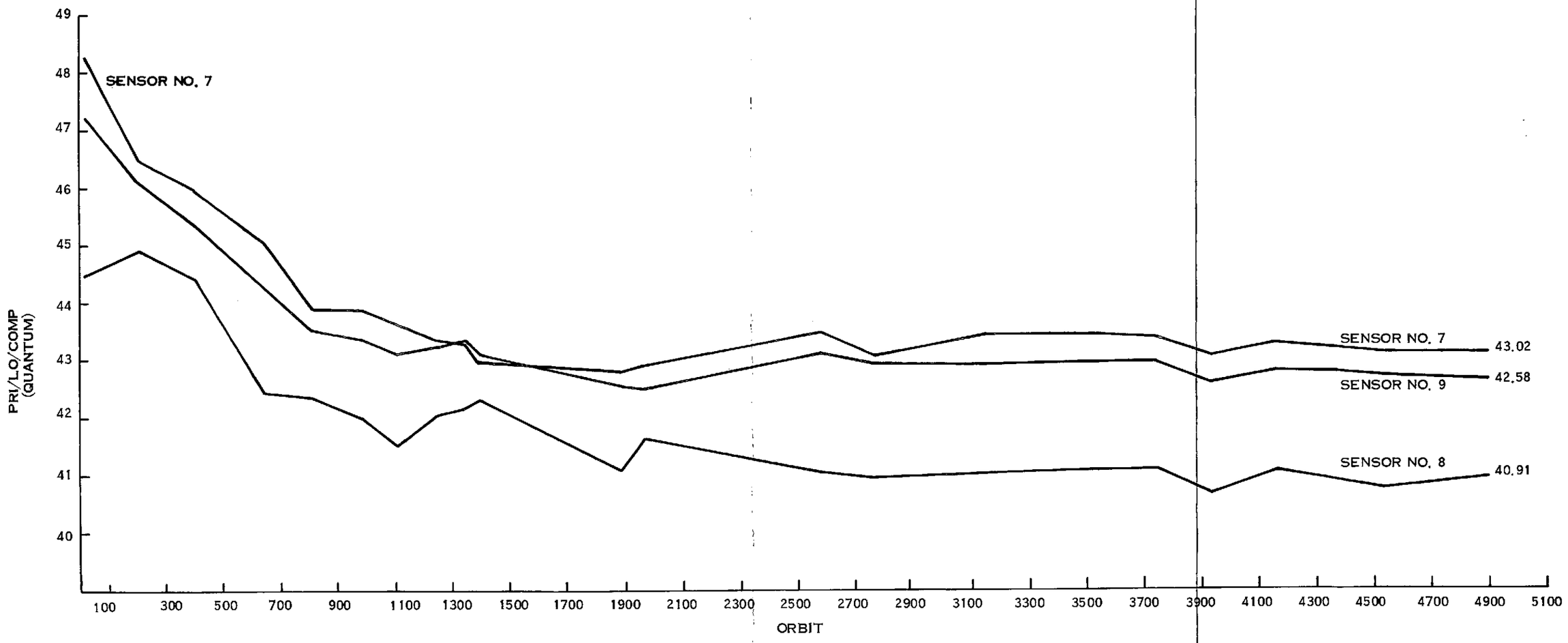


Figure 17-10. Band #2 Quantum vs. Orbit - Word #410

FOLDOUT FRAME 2

FOLDOUT FRAME

FOLDOUT FRAME 2

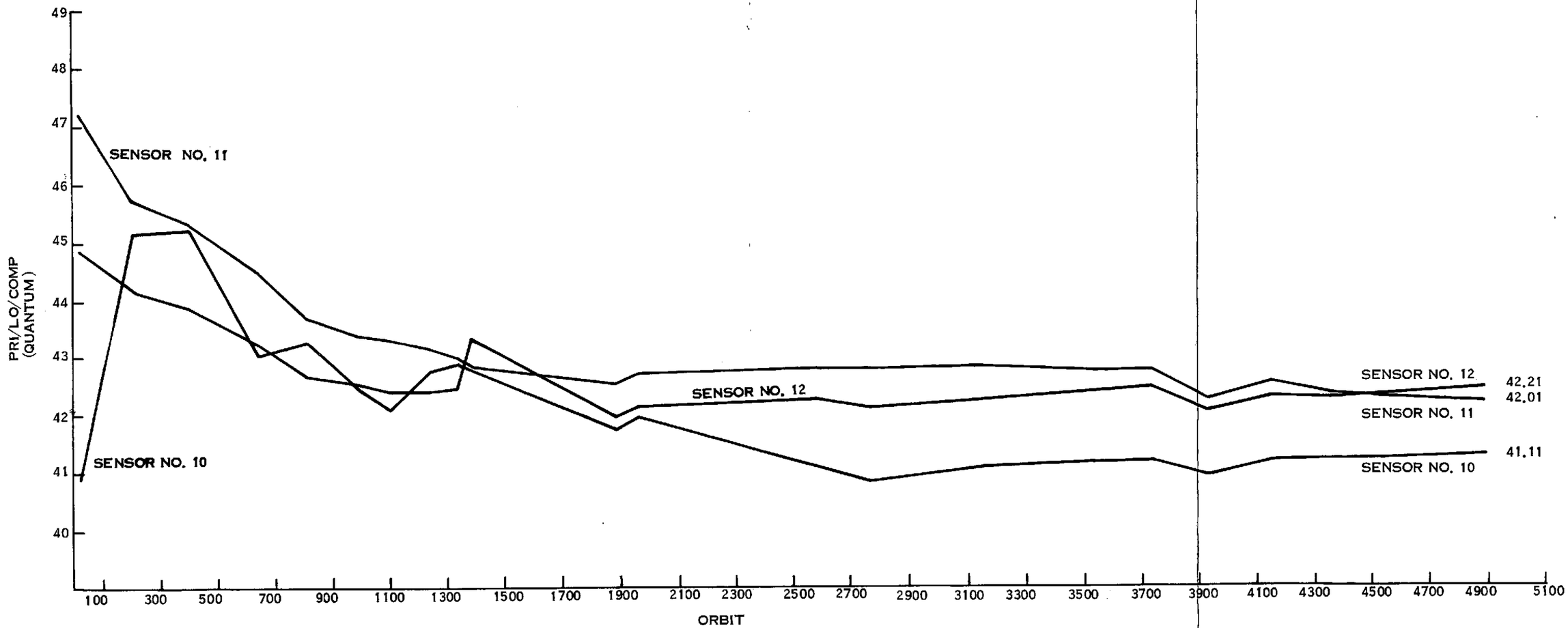


Figure 17-11. Band #2 Quantum vs. Orbit - Word #410

FOLDOUT FRAME 1

FOLDOUT FRAME 2

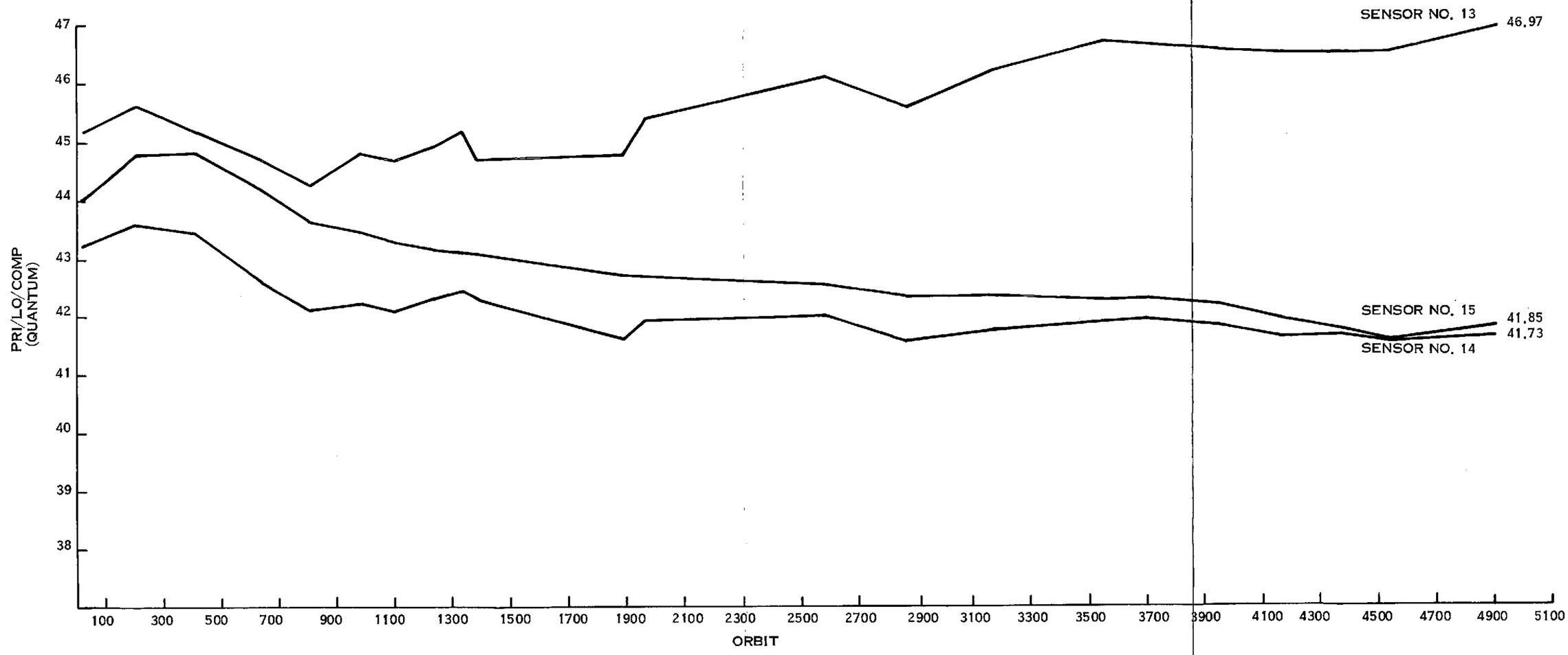


Figure 17-12 Band #3 Quantum vs. Orbit
Word #390

FOLDOUT FRAME

FOLDOUT FRAME 2

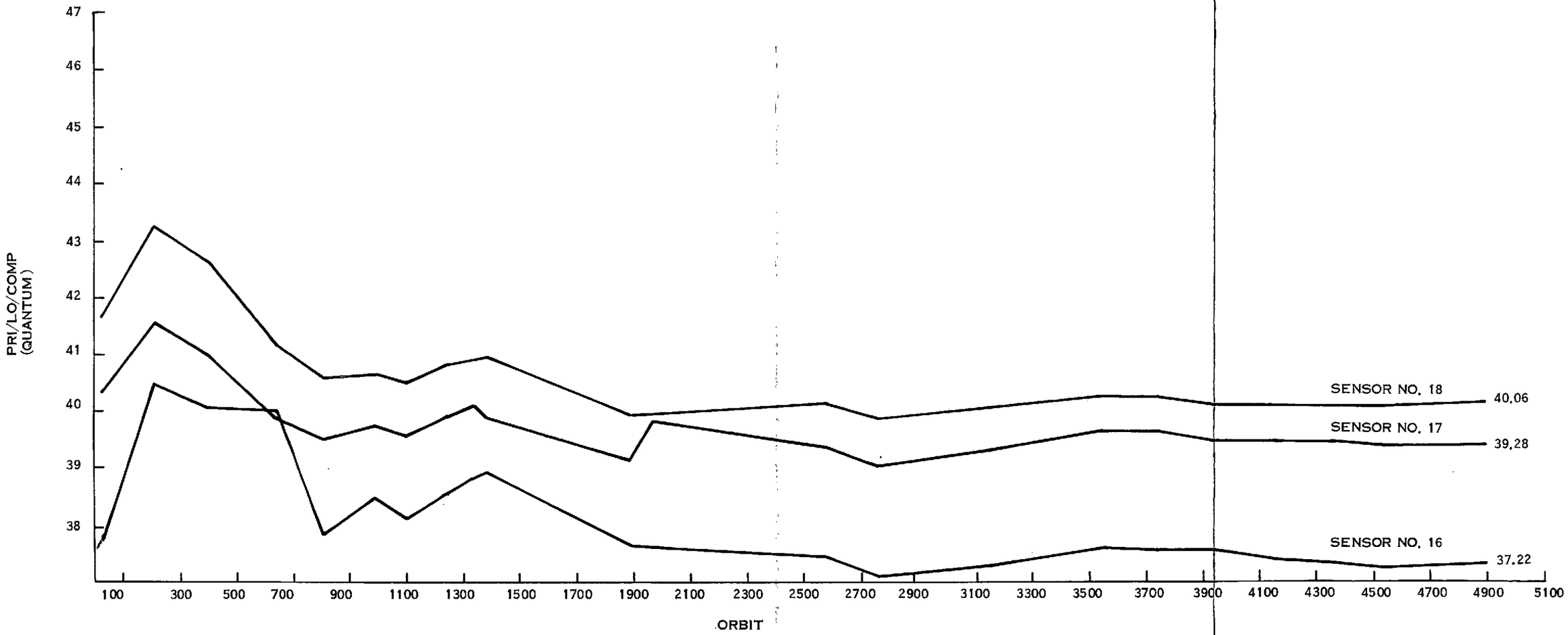


Figure 17-13. Band #3 Quantum vs. Orbit - Word #390

FOLDOUT FRAME 1

FOLDOUT FRAME 2

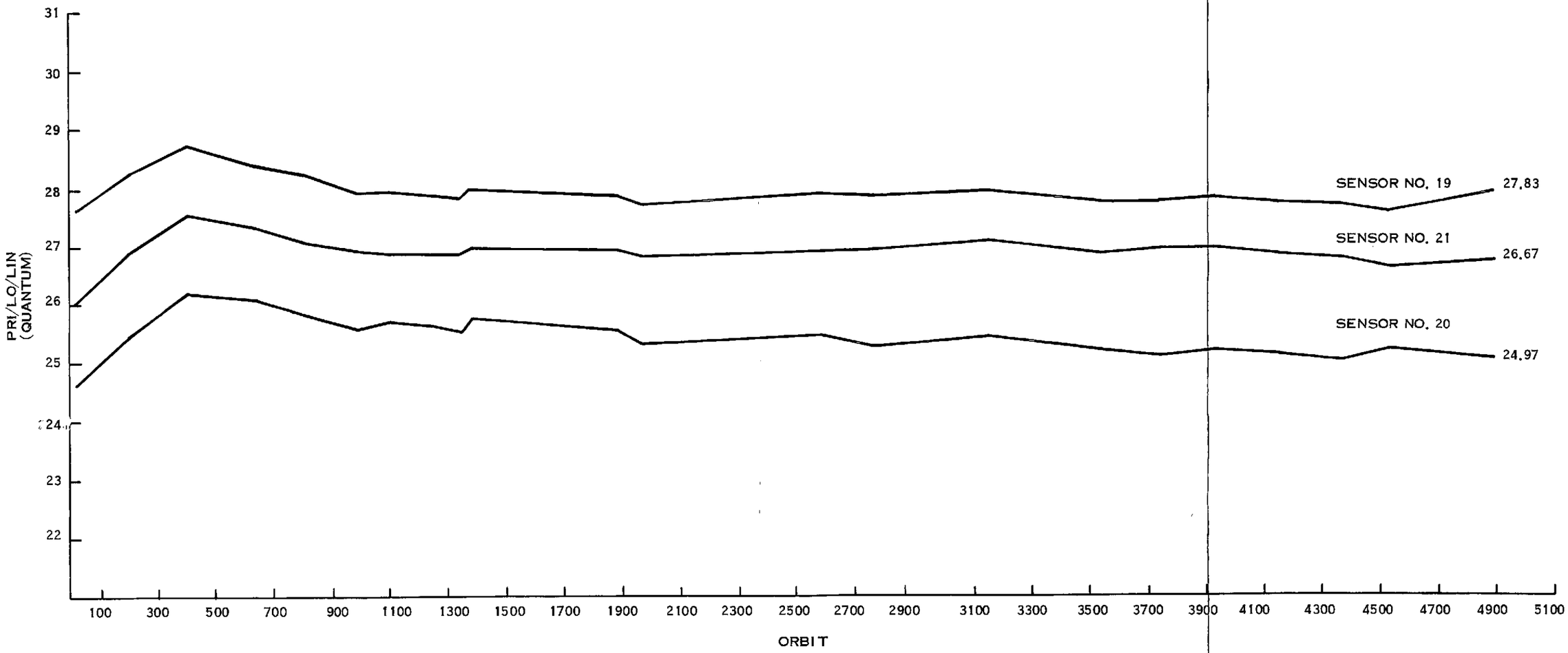


Figure 17-14. Band #4 Quantum vs. Orbit - Word #270

FOLDOUT FRAME 1

FOLDOUT FRAME 2

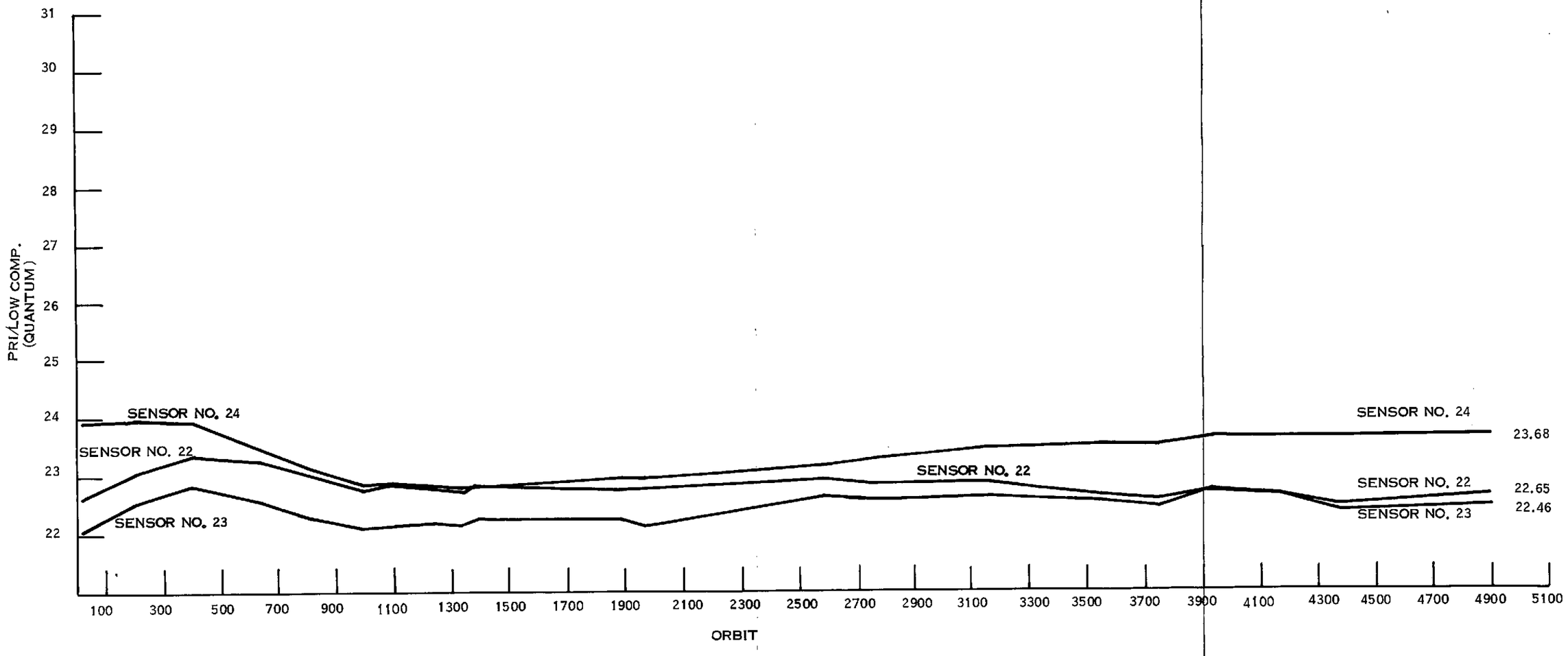


Figure 17-15. Band #4 Quantum vs. Orbit - Word #270

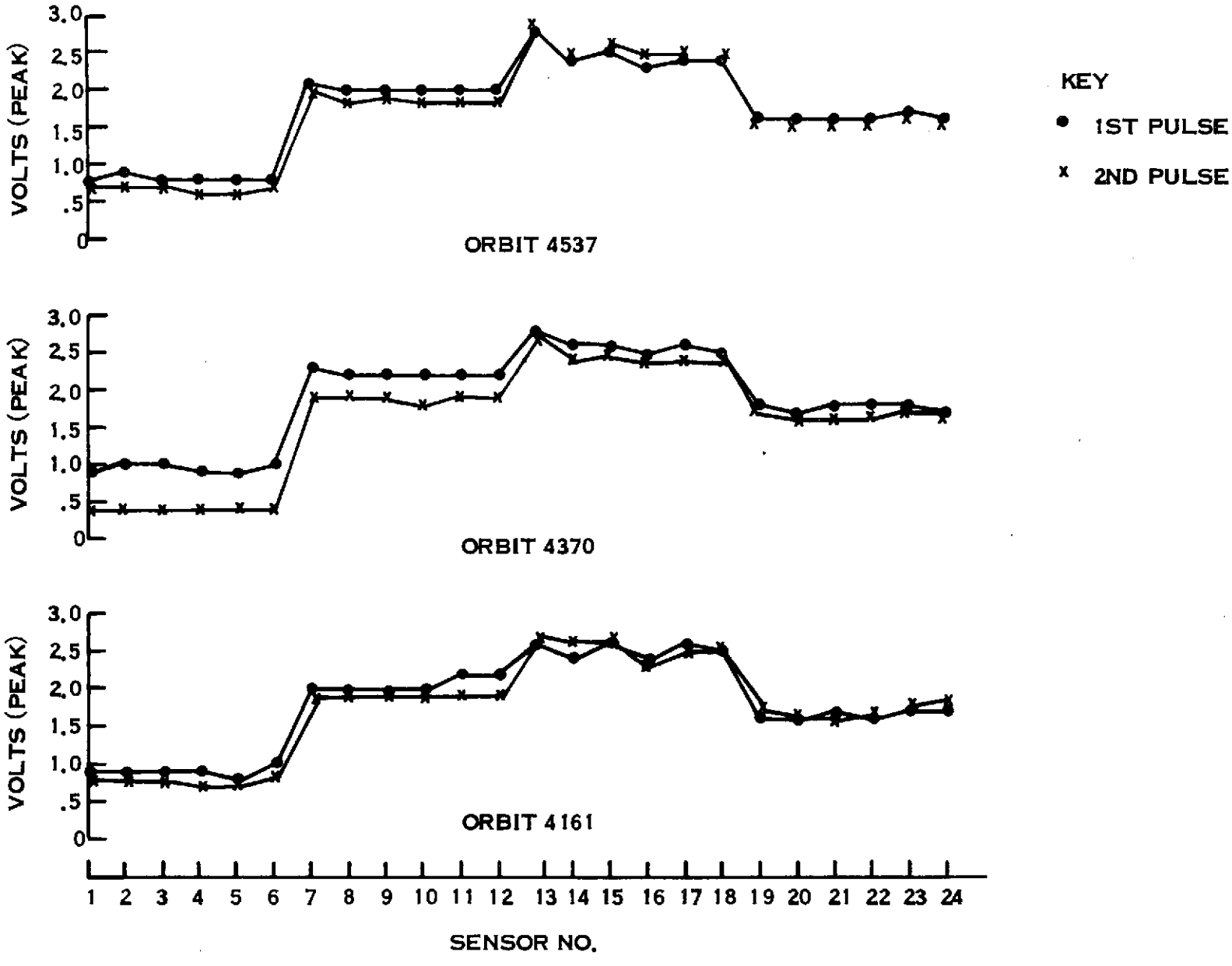


Figure 17-16. Sun Cal Pulse Amplitudes

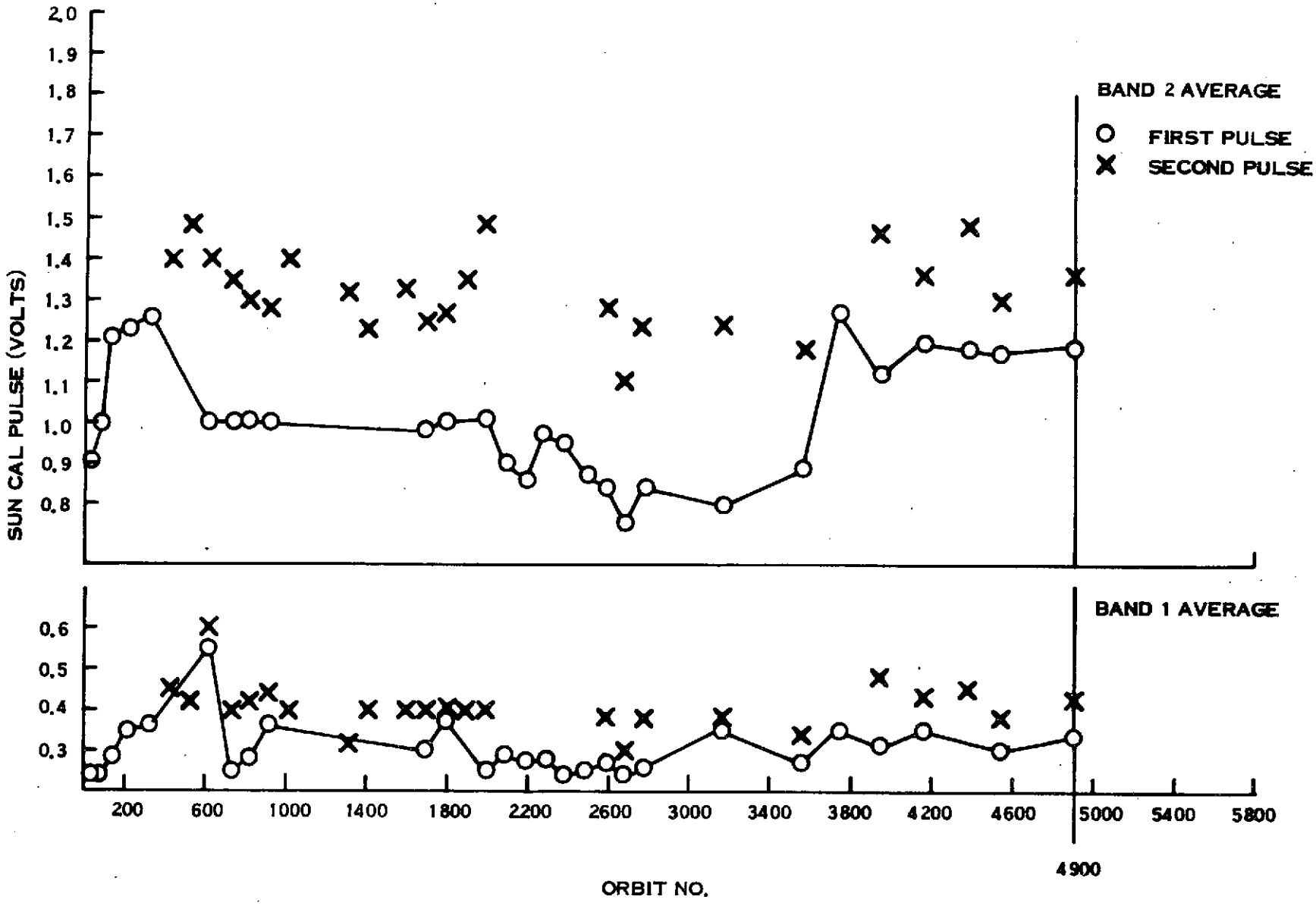


Figure 17-17. Sun Cal Pulse Amplitudes-Primary/Low/Linear

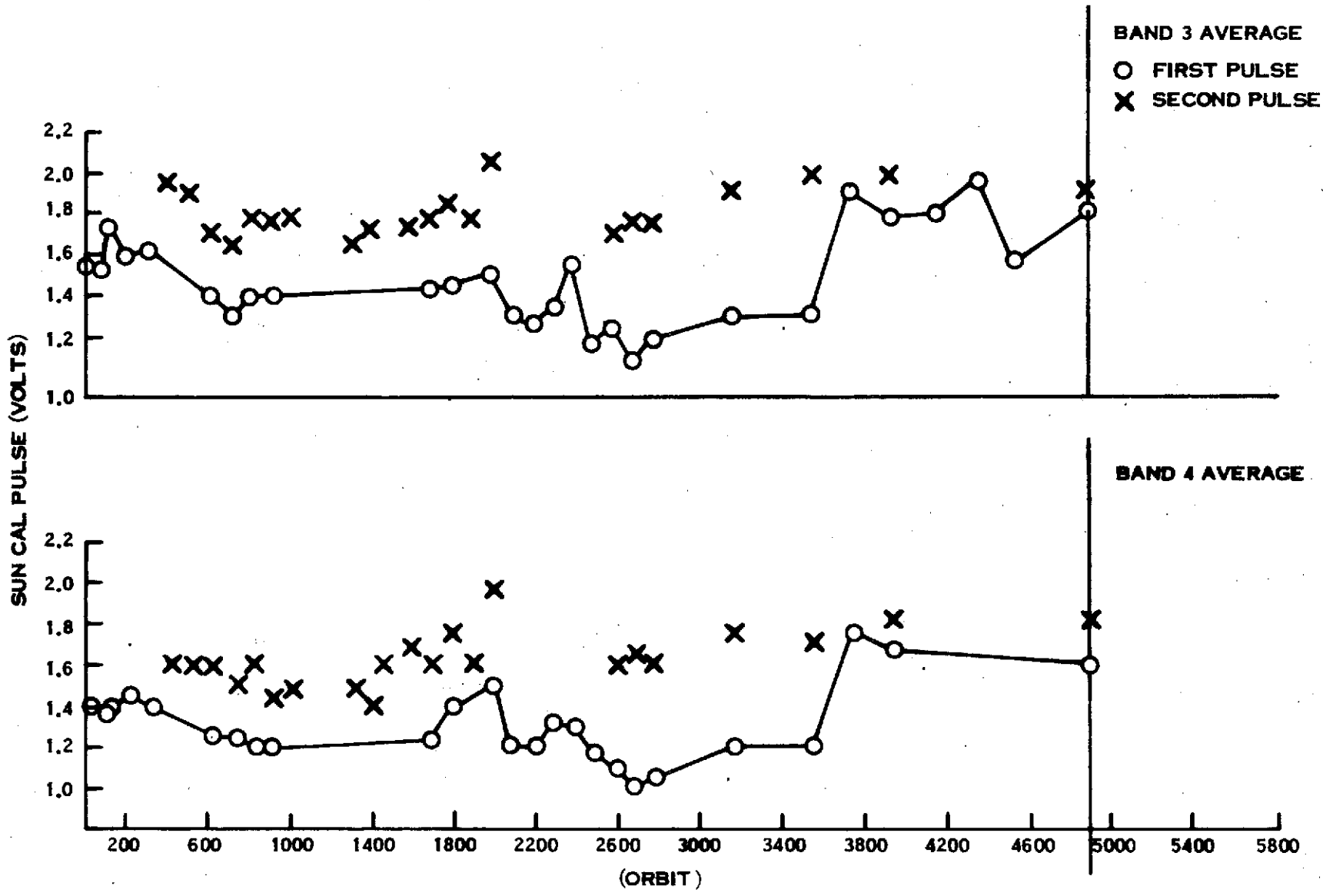


Figure 17-18. Sun Cal Pulse Amplitudes-Primary/Low/Linear

SECTION 18

DATA COLLECTION SYSTEM

SECTION 18

DATA COLLECTION SUBSYSTEM

The Data Collection Subsystem has operated satisfactorily since turn-on in Orbit 5. External interference was minimal during this reporting period.

Since turn-on, the DCS has operated for a cumulative total of 8771:17:50 (h:m:s). Only Receiver 1 has been used to date.

All telemetry functions have been normal as shown in the typical telemetry values of Table 18-1.

Table 18-1. DCS Telemetry Values

Number	Name	Units	T/V* 20 C Plateau	Value In Orbits			
				16	4113	4461	4811
16001	Revr 1 Sig Str	(DBM)	-119.0	-119.0	-123.12	-124.14	-123.36
16002	Revr 1 Temp	(DGC)	23.0	23.0	23.97	23.61	23.74
16003	Revr 1 Inp Volt	(VDC)	12.02	12.02	12.01	12.02	12.01

*Thermal Vacuum Test Data

Since turn-on in Orbit 5, this subsystem has received 403,649 messages of which 368,435 were perfect (91.3%). Periods of heavy interference have added false messages to both "total" messages and "reject" messages, diluting the apparent "error" rate. A detailed study of 577 samples indicate that 99% of the messages sent are received when the S/C is within the horizon of the Data Collection Platform. See Appendix C.

The average time span for receiving DCS data in an orbit was 12.2 minutes. The maximum time span was 15.4 minutes on Orbit 3904.

Figure 18-1 shows the daily DCS messages received during this reporting period, and Figure 18-2 shows the number of messages received daily since 1 August 1972, one week

after launch. Notice the 18-day cycles in rise and decline of total messages received as the successive daily sequence of 14 orbits step about 1.4 degrees to the west, so that on the 18th day, the ground track coincides with the 252nd orbit before. This moves the spacecraft in and out of range of some DCPs at extreme distances, increasing and decreasint the total number of messages received. Notice also the steady rise in messages received per day to its current value of about 1600.

In Table 18-2, the history of the receipt of messages from a selected platform (DCP 6115, located at 39 degrees 58'N, 75 degrees 11'W) is examined. To duplicate the geometric conditions of the radio transmission link, comparison is made between number of messages received in orbit numbers separated by a multiple of 251. It can be seen that with passing time, the system performance has improved. Orbits in cycles 3 and 4 provided only 50 messages. Orbits in cycles 7 and 8 provided the same number. Orbits in cycles 15 and 16 provided 60 messages. Orbits in cycles 18 and 19 provided 70 messages. Even a comparison along each line of Figure 18-2 shows consistent improvement with time.

Table 18-2. History of Message Receipt from DCP 6115

	S/C Cycle Orbits								
	3	4	7	9	15	16	18	19	
REF ORBIT	MSG RECD	MSG RECD	MSG RECD	MSG RECD	MSG RECD	MSG RECD	MSG RECD	MSG RECD	
93	3	--	3	--	3	--	4	--	
100	2	--	3	--	3	--	3	--	
106	2	--	2	--	3	--	4	--	
107	3	--	3	--	4	--	4	--	
113	4	--	4	--	4	--	5	--	
114	3	--	2	--	3	--	3	--	
120	3	--	3	--	3	--	4	--	
121	4	--	3	--	3	--	3	--	
127	3	--	4	--	3	--	4	--	
134	--	3	--	2	--	3	--	4	
135	--	2	--	3	--	7	--	7	
141	--	4	--	4	--	3	--	4	
142	--	2	--	2	--	3	--	3	
148	--	2	--	4	--	3	--	4	
149	--	3	--	4	--	5	--	9	
154	--	3	--	1	--	2	--	3	
155	--	4	--	4	--	5	--	5	
	27	23	26	24	29	31	33	39	Total
	50		50		60		72		Gnd Total

A detailed study was made of 577 messages received from 4 adjacent platforms between 8 July and 14 July 1973. That study is included in Appendix C. Table 18-3 lists the qualitative performance of the DCS subsystem, and includes the results of that study.

Table 18-3. DCS Qualitative Performance

System Threshold	3370Km
Grazing Angle Effects	Not discernible
Adjacent DCP Interference	Not seen
Ground Transmission System	Satisfactory
System Performance:	
Probability of perfect reception of any message	98.96%
Percent of total messages received that are perfect*	91.3%
Percent of perfect messages received that are delivered to user*	89.7%

*See text

From this table, it can be seen that there is about 99% probability that a transmitted message will be received perfectly at OCC. In addition to these messages, however, the system also accepts some noise as messages and then rejects them as non-perfect. This dilutes the true measure of the percent of true messages transmitted that are received perfectly at OCC. The figure of 91.3% is therefore a lower limit and is predominantly a measure of noise rather than of defective system operation. The percent of perfect messages received that are not delivered to users is less than 100% mainly because of the number of test messages, particularly in the first few months. Because of these, the percent value will never reach 100%, but will approach some asymptotic figure from which anomalies will be apparent.

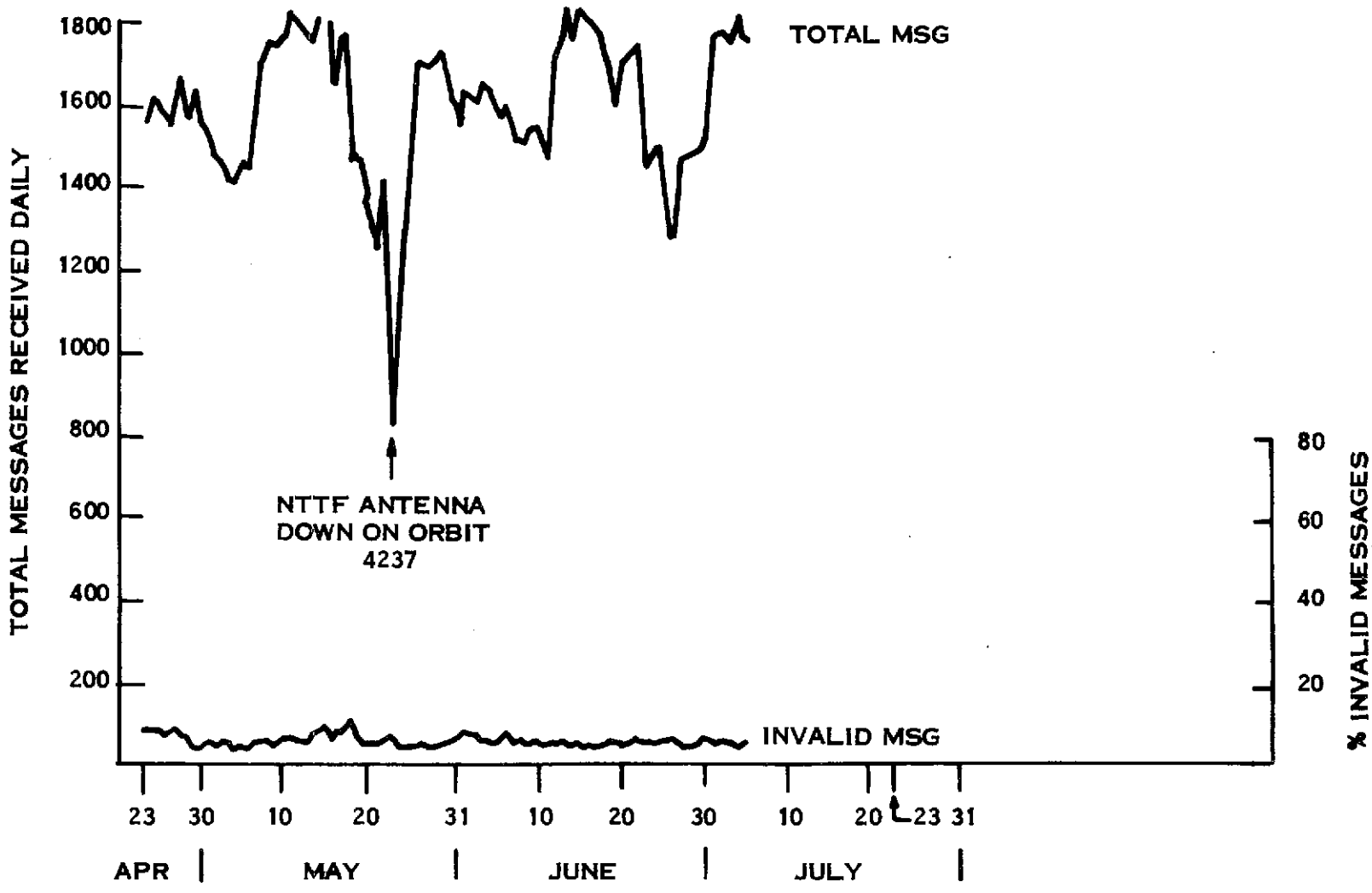


Figure 18-1. DCS Message Receipt History

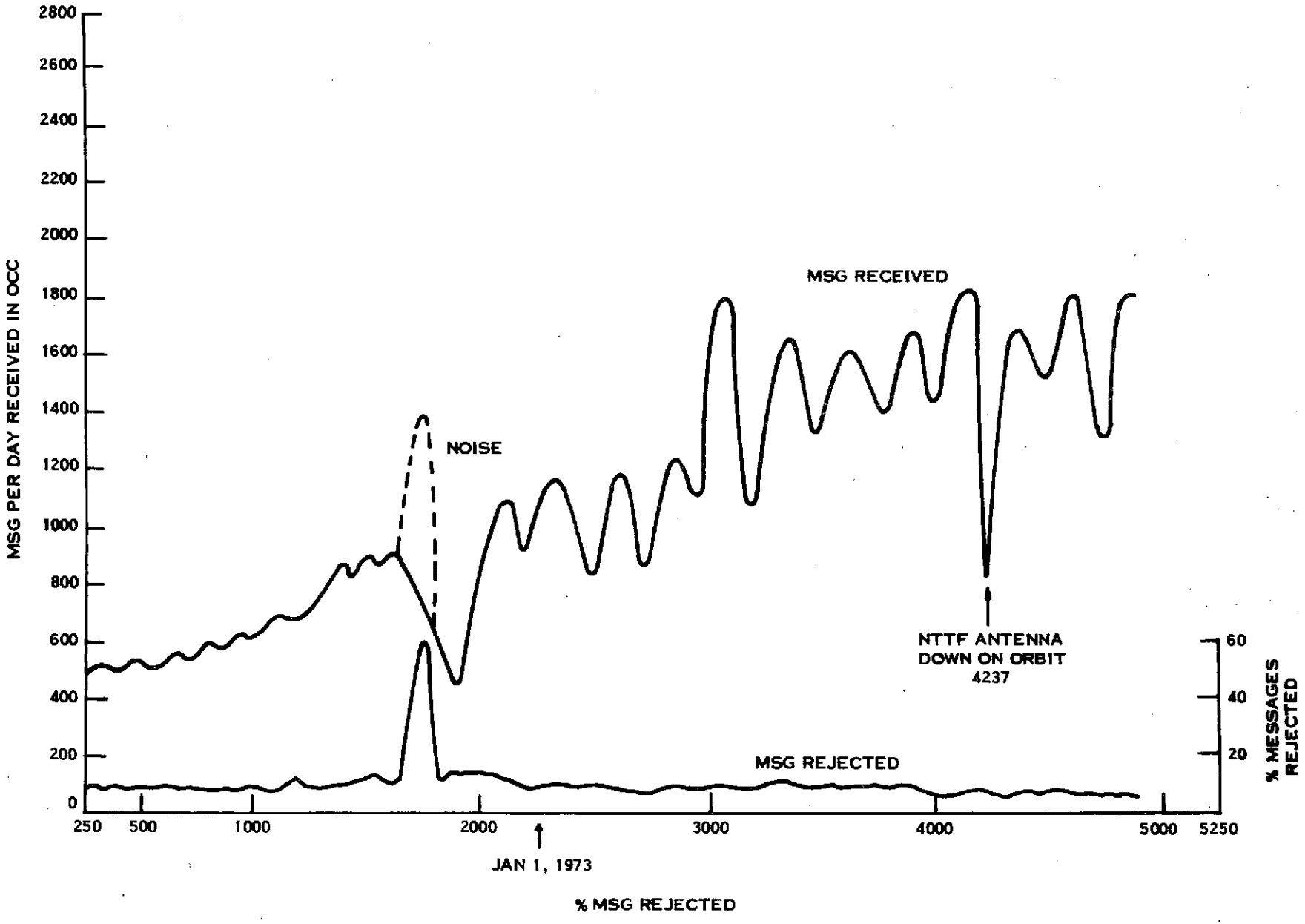


Figure 18-2. DCS Daily Messages Received at OCC

Table 18-4 lists the quantitative performance of the DCS subsystem.

Table 18-4. DCS Quantitative Performance

1.	DCS Platforms Shipped		218
2.	Maximum Platforms Which Have Transmitted Per Day		120
3.	Number of Platforms Currently Active		120
4.	Maximum Number of Platforms Active In One Orbit		105
5.	Total Messages Received At OCC		403,649
6.	Total Messages Rejected		36,072
7.	Maximum Number of Messages Per Day		1828 on 6/13/73
8.	Number Of Orbits With Message Count Exceeding:		
		400 Messages	40
		500 Messages	22
9.	Number Of Current Users		34
10.	Messages Delivered: Total		330,588
	This Quarter:		
	Cards		107,164
	Listings		8,405

APPENDIX A

ERTS-1 ISSUED DOCUMENTS

APPENDIX A

ERTS-1 ISSUED DOCUMENTS

O/L/55	Solar Eclipse on June 30, 1973, 6/29/73
PIR 1T23-ERTS-89	Monitoring of MSS Playback via the WBVTR, 5/3/73
PIR 1T23-ERTS-91	Monitoring WBVTR-1 Quality Via MSFE Counts, 5/9/73
PIR 1T23-ERTS-93	Failure of ERTS-1 Telemetry Gates in Orbit 4396, 6/20/73
PIR 1T23-ERTS-94	ERTS-1 ACS Gating History Trend, 7/10/73
PIR 1T23-ERTS-96	ERTS-1 Spacecraft Clock Drift 7/26/73
PIR 1T23-ERTS-97	DCS Subsystem Performance
PIR 1H05-563	Nimbus 5 and ERTS-1 Shunt Load Operational Constraint, 6/19/73

APPENDIX B

ERTS-1 ANOMALY LIST/REPORTS

OBSERVATORY ANOMALIES

Date	Anomaly	How Observed	Comments
7/24/72	Sun Sensor Temperature High	Off-Line	No Action Required For ERTS-1; ERTS-B Redesigned
7/24/72	Solar Paddle Temperature Excursions Greater Than Expected	Off-Line	No Action Required For ERTS-1; Math Model Corrected
7/25/72	USB Power Output Decreasing	Off-Line	Will Switch to Side B When Necessary; Under Investigation for ERTS-B
8/03/72	WBVTR No. 2 Power Converter Shorted	Real Time & Off-Line	Turned All P/L Off During Pass. Formed NASA/GE/RCA Evaluation Committee. Disconnected since Anomaly. Redesigned for ERTS-B
8/03/72	Decrease In Solar Array Current	Off-Line	Evaluate Degradation Effect Due To Solar Flare Activity
8/06/72	RBV Power Transient PSM Turn-Off Failure	Real Time	Turned Off PRM. NASA/GE/RCA Evaluation Committee Formed; Disconnected Since Anomaly; Redesign PSM For ERTS-B
8/10/72	DCS Reject Messages Rose To Over 40% of Total Messages For 15 Days	Off-Line	External Interference; Located Source; No Serious Interference Since.
8/10/72	MSS Cal Wedge Levels Decreasing	Off-Line	Leveled Off After Orbit 1000; At Or About 5% Below Earlier Values
9/03/72	Incorrect Time Tags In Comstor Cell 12	Real Time	Reload Comstors And Verify; (Discontinued Active Use of Cell 12)
12/04/72 12/06/72	Pitch, Roll, Yaw } Motor Drive Duty Cycles Increased For Short Period	Off-Line	Evaluate - Prepared Contingency Plan. Under Investigation For ERTS-B
3/29/73	WBVTR NO. 1; High BER	Real Time	Formed NASA/GE/RCA Committee; Lapped Heads; Now In Operational Use, Temporarily Restricted to Last 350 Feet (350 Seconds) Of Tape
4/08/73	Slow Leak In Forward IR Scanner Pressure	Off-Line	Not Expected To Interfere With Normal Operations
5/20/73	Defect In Signal Of Left Cosine Pot at S/C Midnight	Off-Line	Not Expected To Interfere With Normal Operations
6/03/73	Failure Of Integrated Circuit Chip and TLM of Functions 6012, 1011, 12238 And 7010	Real Time And Off-Line	Thm Failure only. S/C operations normal.

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
PIR NO.	— 1T23	— ERTS —	93	

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
Daniel Wise	T. W. Winchester

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
June 20, 1973			GSFC Malfunction Report No. D05838 (copy attached)

SUBJECT

Failure of ERTS-1 Telemetry Gates in Orbit 4396

INFORMATION REQUESTED/RELEASED

The LISP off-line program gave the first indications of abnormal data after processing of telemetry from the Narrow Band Tape Recorder dump in orbit 4396. At the next pass (Alaska 4397) battery 2, which had erroneous charge readings, was turned off. Subsequent investigation by use of DLP showed that four telemetry gates which are mounted on one Integrated Circuit Chip were giving false readings. The battery was established to have been charging and discharging correctly after the telemetry failure so it was turned back on in orbit 4407 and has been performing well.

The failed telemetry functions are shown below:

Function	Description	Gate	Sample Rate	Column	Row
6012	Battery 2 Charge Current	161	1/16	12	17
1011	Rear Scan Trail Earth Pulse	169	1/16	15	18
12238	WFMA -5 Reg Voltage	177	1/16	18	19
7010	Temperature, Seperator No. 7, Top Inboard	185	1/16	01	21

The DLP indicated the following data:

1. Function 1011 and 12238 failed at 154:23:11:07 when their first sample showed erroneous data. They are in row 18 and 19. Note that function 6012 did not indicate as a failure so that the failure occurred between sampling of function 6012 (column 12, row 17) and function 1011 (column 15, row 18). Note also that function 7010 (column 01, row 21) did not show a failure in this major frame even though it is sampled after functions 1011 and 12238 which did show a failure.

2. Function 6012 (column 12, row 17) indicated a failure at 154:23:11:23 which is the first sample after function 1011 and 12238 failed. This is still consistant with the theory that the failure occurred after 6012 was sampled and before function 1011 was sampled as discussed in 1 above. Note that 7C10 still did not show a failure in this major frame though functions 6012, 1011, and 12238 do.

L. Seaman U-2101
H. Boys U-2101
G. Ehrgott U-2215
T. Wilks U-2113
D. Rehmann U-2407
B-2

L. Gonzales Code 430
L. Smith Code 430
G. Branchflower Code 430
H. Neumann Code 732.A

PAGE NO. ____ OF ____

✓ RETENTION REQUIREMENTS

COPIES FOR	MASTERS FOR
☐ 1 MO.	☐ 3 MOS.
☐ 3 MOS.	☐ 6 MOS.
☐ 6 MOS.	☐ 12 MOS.
☐ MOS.	☐ MOS.
☐	☐ DO NOT DESTROY

FORM 1020B REV. (9-70)

3. Function 7010 indicated a failure at 154:23:11:40 which is two major frames from the initial failure of functions 1011 and 12238. This seems to indicate that this failure was delayed in relation to the other functions.

4. Functions 6075, 14204, 16002, and 1224 which are analog gates 193, 201, 209, and 217 did not show any signs of abnormal readings.

5. Functions 1244, 15109, 14305, 13023, 7002, 12232, and 1010 which are analog gates 153, 145, 137, 129, 121, 113, and 105 did not show any signs of abnormal readings.

6. Functions 1266, 6025, 1038, 8010, 7045, 14309, 12236, 1267, 6026, 11104, 8016, 7054, 13028, 14310, 1040, 1096, and 3001 which are analog gates 346, 354, 362, 370, 378, 394, 402, 410, 418, 426, 434, 442, 450, 458, 608, 616 and 624 did not show any signs of abnormal readings.

7. The DLP for orbit 4398 showed a "hiccup" in value of failed telemetry functions 6012, 12238, 7010 at 155:01:35:03.

8. The DLP for orbit 4400 showed a "hiccup" in value of failed telemetry functions 12238 and 7010 at 155:04:53:27.

A list of attached computer printouts and telemetry schematics is included below.

1. Limit Summary Orbit 4396.
2. Limit Summary Orbit 4397.
3. Data Listing Program Orbit 4396.
4. Data Listing Program Orbit 4398.
5. Data Listing Program Orbit 4400.
6. Command History Orbit 4397.
7. Command History Orbit 4407.
8. Schematic of Function 6012 Telemetry.
9. Schematic of Function 1011 Telemetry.
10. Schematic of Function 12238 Telemetry.
11. Schematic of Function 7010 Telemetry.

A plot of mean, max, and minimum values from SCEST are included on graphs for functions 6012, 1011, 12238, and 7010. Note that battery 2 charge current indicates even while battery 2 is disconnected by a relay. Function 1011 is saturated. Functions 6012, 12238, and 7010 vary their maximum and minimum values but the average maintains a close value. The four graphs are attached in this report.

DW/jwb

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY . . .
(MAIL: 5030 HERZEL PLACE, BELTSVILLE, MARYLAND 20705), Phone (301) 345-6000

SPACE DIVISION

SPACE SYSTEMS
ORGANIZATION

June 13, 1973

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Attention: Mr. C. Rice, Code 430.0

Enclosed please find a preliminary copy of ERTS Malfunction Report.

Copies are herewith transmitted in accordance with program requirements.

PRELIMINARY REPORT NO.	PROGRAM	SUBCONTRACTOR IDENTIFICATION	COMPONENT NAME
D05838	ERTS	G. E.	Telemetry Functions 1011, 7010, 12238, and 6012.

Very truly yours,

E. J. Maginnis

E. J. Maginnis
Observatory Systems Q.C. Engineering
Rm. W415, Building 23, GSFC, X5707

EJM/jwb

GSFC MALFUNCTION REPORT

NO D 05838

(1) Project: ERTS	(2) Spacecraft: ERTS-1	(3) Operation: 17568	(4) Units: HRS [X] CYS [ ]
(5) System or Experiment:	(6) Date & Time of Malfunction: Yr 73 Mo 06 Day 04 Time 0110	(7) Date of Report: Mo 06 Day 11	(8) Critical: YES [X] NO [ ]

	NAME	IDENTIFICATION NUMBER	SERIAL NUMBER	MANUFACTURER
(9) Component				
(10) Assembly				
(11) Sub-Assembly				
(12) Part		Manufacturers Part Number		

(13) Malfunction Occurred During: 1 [ ] Qualification Test 2 [ ] Acceptance Test 3 [ ] Integration Test 5 [ ] Launch Operations 7 [ ] Bench Test 8 [X] Post Launch

(14) Environment When Failed: 1 [ ] Acceleration 2 [ ] Shock 3 [ ] Thermal-Vacuum 4 [ ] Temperature 5 [ ] Humidity 6 [ ] Vibration 7 [ ] Ambient 8 [ ] Acoustic A [ ] RFI/EMC 0 [ ] Vacuum

(15) Hardware Level When Failed: 1 [ ] Part 2 [ ] Sub-Assembly 3 [ ] Assembly 4 [ ] Component 5 [ ] System 6 [X] Spacecraft

(16) REFERENCE
Spacecraft Log Book # OS Log Page Orbit 4397 Test Procedure ____ Para ____

(17) Description of the Malfunction: Four telemetry point indicating erroneous data.

Function #	Telemetry Nomenclature
1011	Rear Scan Earth Pulse
7010	Separator #7 Top Inboard
12238	-5 Volt (Reg) A1
6012	Batt 2 Charge Current

(18) Originator: E. J. Maginnis Phone: 982-5707 Organization: Quality Control, NOPE

Do Not Write Below This Line

Q.C. - E J Maginnis
Eng - [signature]
Project Mana[ger] [signature]

INSTRUCTIONS

(1) Originator – Fill in blocks (1) through (18), with all known information, as defined in instructions on the back of this form.

(2) Distribute copies in accordance with project directions.

77

Copy 1

LIMIT SUMMARY ERTS-A FLT ORBIT NO. 43961A SOURCE NBTR B USB PROCESSED 00114 JUN 04,'73 SYSTEM TAPE 22-548 PAGE 1
DATA ORIGIN 03 JUNE 73 FROM 22/05/27 (001) TO 23/46/47 (381) XX.XX % BAD XX.XX % SMOOTH SYSTEM TAPE 022-548
ERROR LIMIT PERCENTAGE * 1

LIMIT	FUNCTION	EVENT	MODE	MINIMUM VALUE	LOWER LIMIT	UPPER LIMIT	MAXIMUM VALUE	TOTAL SAMPLES	SAMPLES OUT OF LIMITS	
	*** ACS SUBSYSTEM ***									
1011	RSC T EP				.00 (.00 MS)	1.10 (20.00 MS)	3.00	381		135 HI
1020	R LD AMP				2.62 (-1.94 DEG)	3.27 (1.08 DEG)	3.32	6096		643 HI
	*** PWR SUBSYSTEM ***									
6042	RPAD V M	SATELITE	DAY	2.45	3.90 (29.87 VDC)	5.12 (39.26 VDC)		259	6 LO	
6044	LT PAD T			.87	1.02 (-61.00 DGC)	5.65 (72.00 DGC)		381	17 LO	
	*** THM SUBSYSTEM ***									
7010	THO7STI	TLM PWR	ON		2.37 (10.31 DGC)	4.05 (30.28 DGC)	4.07	381		34 HI
	*** NBR SUBSYSTEM ***									
10001	MOTR I 1	RECRDR 1	REC	.05	2.40 (151.58 MA)	3.90 (246.32 MA)		21	1 LO	
10002	PS CUR 1	RECRDR 1	PB	.07	3.40 (390.54 MA)	5.00 (600.00 MA)		17	1 LO	
	*** USB SUBSYSTEM ***									
11002	XMTR PWR	USB XMTR	ON	.15	2.50 (.26 WTS)	4.95 (1.51 WTS)		48	1 LO	
	*** WPA SUBSYSTEM ***									
12102	HELX I 2	2 STATUS	LOW		2.22 (4.91 MA)	2.60 (5.40 MA)	4.37	1		1 HI
12103	CATH I 2	2 STATUS	LOW	.00	3.70 (33.28 MA)	3.80 (34.08 MA)		1	1 LO	
12104	FWD PW 2	2 STATUS	LOW		3.65 (39.45 DBM)	4.90 (41.49 DBM)	5.15	1		1 HI

ERROR LIMIT	LIMIT FUNCTION	PERCENTAGE EVENT	* MODE	1 MINIMUM VALUE	LOWER LIMIT	UPPER LIMIT	MAXIMUM VALUE	TOTAL SAMPLES	SAMPLES OUT OF LIMITS	
	*** WFM SUBSYSTEM ***									
12228	MODE L S	INV PWR	ON	.00	2.55 (2.48 MHZ)	3.55 (2.51 MHZ)		42	1 LO	
12238	.5V A	INV A	OFF		.00 (.00 TMV)	.10 (.10 TMV)	3.50	339		130 HI
		INV A	ON	3.30	5.00 (5.00 TMV)	5.40 (5.40 TMV)		42	5 LO	
12241	-24.5 M2	INV PWR	ON	.00	4.90 (4.90 TMV)	6.20 (6.20 TMV)		42	1 LO	
	*** WBR SUBSYSTEM ***									
13027	HWP MS 1	HD WHL 1	ON	.00	3.15 (90.12 PCT)	4.00 (110.12 PCT)		1	1 LO	

LIMIT SUMMARY ERTS-A FLT ORBIT NO- 43971A SOURCE NBTR A USB PROCESSED 02:13 JUN 04,'73 SYSTEM TAPE 22-548 PAGE 1
DATA ORIGIN 03 JUNE 73 FROM 23/46/47 (001) TO 01/27/51 (380) XX.XX % BAD XX.XX % SMOOTH SYSTEM TAPE 022-548

ERROR LIMIT FUNCTION	PERCENTAGE EVENT	* MODE	1 MINIMUM VALUE	LOWER LIMIT	UPPER LIMIT	MAXIMUM VALUE	TOTAL SAMPLES	SAMPLES OUT OF LIMITS	
ACS SUBSYSTEM									
1011 RSC T EP				.00 (.00 MS)	1.10 (20.00 MS)	3.90	380		380 HI
1020 R LD AMP				2.62 (-1.94 DEG)	3.27 (1.08 DEG)	3.32	6080		465 HI
AMS SUBSYSTEM									
3001 ROLL -				.00 (.00 DEG)	3.17 (-1.00 DEG)	3.40	6080		191 HI
PWR SUBSYSTEM									
6044 LT PAD T			.87	1.02 (-61.00 DGC)	5.65 (72.00 DGC)		380	17 LO	
THM SUBSYSTEM									
7010 TH07STI	TLM PWR	ON		2.37 (10.31 DGC)	4.05 (30.28 DGC)	4.15	380		27 HI
NBR SUBSYSTEM									
10102 PS CUR 2	RECRDR 2 REC		.00	1.90 (216.88 MA)	2.95 (353.25 MA)		6	1 LO	
WFM SUBSYSTEM									
12238 -5V A	INV A	OFF		.00 (.00 TMV)	.10 (.10 TMV)	4.05	299		299 HI
	INV A	ON	3.30	5.00 (5.00 TMV)	5.40 (5.40 TMV)		81	81 LO	
WBR SUBSYSTEM									
13026 CPST M61	CAPST 1	ON	.87	3.47 (89.95 PCT)	4.37 (110.14 PCT)		48	1 LO	

TIME DDD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	SV A TMV 18/19 12238	TH07ST1 DGC 1/21 7010	PRM8D T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS R? T DGC 10/24 16002	SDR FSST DGC 12/25 1224
154/22/58/15	199. 1	.00 / 7	12.27 / 1	.00 / 26	20.15 / 3	23.87 / 5	18.94 / 8	23.79 / 17	73.00 / 1
154/22/58/31	200. 1		12.73 / 1						
154/22/59/03	202. 1		12.27 / 2					24.21 / 3	
154/22/59/19	203. 1		12.73 / 1						72.00 / 4
154/23/00/39	208. 1								71.00 / 5
154/23/01/11	210. 1		12.27 / 7						
154/23/01/27	211. 1		12.73 / 1						
154/23/01/43	212. 1		13.18 / 1						
154/23/01/59	213. 1		12.73 / 1			23.50 / 14			70.00 / 6
154/23/02/15	214. 1		12.27 / 1						
154/23/02/31	215. 1		12.73 / 1						
154/23/02/47	216. 1		13.18 / 1						
154/23/03/19	218. 1								69.00 / 6
154/23/03/35	219. 1		12.73 / 3						
154/23/04/07	221. 1		12.27 / 2						
154/23/04/39	223. 1							24.64 / 21	68.00 / 6
154/23/05/43	227. 1								67.00 / 4
154/23/05/59	228. 1		12.73 / 7						
154/23/06/15	229. 1		13.18 / 1						
154/23/06/47	231. 1		12.27 / 2						66.00 / 4
154/23/07/03	232. 1		12.73 / 1						
154/23/07/19	233. 1		13.18 / 1						
154/23/07/35	234. 1		12.73 / 1						

DATA LISTING PRGRM GRTS-A FLT ORBIT NO. 0043961A SOURCE NBTR B USB PROCESSED 23:40 JUN 03,'73 SYSTEM TAPE 022-548 PAGE 24
DATA ORIGIN 03 JUNE 73 FROM 22/05/27 (001) TO 23/46/47 (381) CAL 00.00 % BAD 00.01 % SMOOTH SYSTEM TAPE 022-548

TIME DOD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	THO7STI DGC 1/21 7010	PRMOD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS RT T DGC 10/24 16002	SDR FSST DGC 12/25 1224
154/23/07/51	235 1	.00 / 36	12.73 / 1	.00 / 36	20.15 / 36	23.50 / 22	18.94 / 36	24.64 / 12	66.00 / *
154/23/08/07	236 1		12.27 / 1						65.00 / 1
154/23/09/11	240 1								64.00 / *
154/23/09/27	241 1		12.73 / 5						
154/23/10/15	244 1								63.00 / *
154/23/10/31	245 1		13.18 / *			23.12 / 10			
154/23/10/47	246 1		12.73 / 1						
154/23/11/03	247 1		20.00H/ 1		3.47H/ 12	← 154:23:11:07			
154/23/11/19	248 1	.83 / 13			3.50H/ 1				62.00 / *
154/23/11/35	249 1	.86 / 1				30.58H/ 14	← 154:23:11:40		
154/23/11/51	250 1	.84 / 1							
154/23/12/23	252 1	.88 / 2							61.00 / *
154/23/12/39	253 1	.89 / 1							
154/23/12/55	254 1	.87 / 1							
154/23/13/11	255 1	.84 / 1							
154/23/13/27	256 1	.87 / 1							60.00 / *
154/23/13/43	257 1	.86 / 1							
154/23/13/59	258 1	.88 / 1							
154/23/14/15	259 1	.87 / 1							
154/23/14/31	260 1	.86 / 1							59.44 / *
154/23/14/47	261 1	.88 / 1							
154/23/15/03	262 1	.83 / 1							
154/23/15/19	263 1	.87 / 1					19.49 / 28		

154:23:11:23

FULL SCALE

TIME DDD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	THO7STI DGC 1/21 7010	PRMOD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS RT T DGC 10/24 16002	SDR FSST DGC 12/25 1224
154/23/15/35	264- 1	.87 / 1	20.00H/ 17	3.50H/ 16	30.58H/ 15	23.12 / 19	18.94 / 1	24.64 / 29	58.89 / 4
154/23/15/51	265- 1	.84 / 1							
154/23/16/07	266- 1	.86 / 1							
154/23/16/23	267- 1	.87 / 1							
154/23/16/39	268- 1	.86 / 1		3.47H/ 4			19.49 / 4		58.33 / 4
154/23/16/55	269- 1						18.94 / 1		
154/23/17/11	270- 1						19.49 / 1		
154/23/17/27	271- 1	.85 / 3							57.78 / 3
154/23/17/43	272- 1	.86 / 1							
154/23/17/59	273- 1						18.94 / 3		
154/23/18/15	274- 1	.87 / 2							
154/23/18/31	275- 1	.86 / 1							57.22 / 4
154/23/18/47	276- 1	.86 / 1							
154/23/19/03	277- 1	.86 / 1							
154/23/19/19	278- 1	.87 / 1		3.45H/ 10					56.66 / 3
154/23/19/35	279- 1	.86 / 1							
154/23/19/51	280- 1	.88 / 1					19.49 / 7		
154/23/20/07	281- 1	.86 / 1			30.28 / 17				
154/23/20/23	282- 1	.88 / 1					18.94 / 2		56.11 / 4
154/23/20/39	283- 1	.86 / 1				22.75 / 19			
154/23/20/55	284- 1	.86 / 1					19.49 / 2		
154/23/21/11	285- 1						18.94 / 1		
154/23/21/27	286- 1	.86 / 2				23.12 / 3			55.55 / 4

DATA LISTING PROGRAM ERTS-A FLT ORBIT NO. 0043961A SOURCE NBTR B USB PROCESSED 23:40 JUN 03,173 SYSTEM TAPE 022-548 PAGE 26
DATA ORIGIN 03 JUNE 73 FROM 22/05/27 (001) TO 23/46/47 (381) CAL 00.00 % BAD 00.01 % SMOOTH SYSTEM TAPE 022-548

TIME DDD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	THO7STI DGC 1/21 7010	PRMOD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS RT T DGC 10/24 16002	SDR FSST DGC 12/25 1224
154/23/21/43	287 1	.87 / 1	20.00H/ 23	3.45H/ 9	30.28 / 6	22.75 / 1	18.94 / 2	24.64 / 23	55.55 / 1
154/23/21/59	288 1	.88 / 1							
154/23/22/15	289 1	.86 / 1							55.00 / 2
154/23/22/31	290 1			3.42H/ 3					
154/23/23/03	292 1	.87 / 3							54.44 / 3
154/23/23/19	293 1	.86 / 1							
154/23/23/35	294 1	.86 / 1							
154/23/23/51	295 1								53.89 / 3
154/23/24/23	297 1	.84 / 3		3.40H/ 7					
154/23/24/39	298 1	.84 / 1							53.33 / 3
154/23/25/11	300 1	.86 / 2							
154/23/25/27	301 1				29.98 / 14				
154/23/25/43	302 1	.86 / 2			30.28 / 1				52.78 / 4
154/23/25/59	303 1	.87 / 1			29.98 / 1				
154/23/26/15	304 1			3.37H/ 7					52.22 / 2
154/23/26/31	305 1	.87 / 2							
154/23/26/47	306 1	.86 / 1							
154/23/27/03	307 1	.88 / 1		3.35H/ 3					51.66 / 3
154/23/27/19	308 1	.84 / 1							
154/23/27/35	309 1	.86 / 1							
154/23/28/07	311 1	.86 / 2							51.11 / 4
154/23/28/23	312 1	.86 / 1							
154/23/28/39	313 1	.86 / 1							

TIME DDD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	THO7STI DGC 1/21 7010	PRMGD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS RT T DGC 10/24 16002	SOR FSST DGC 12/25 1224
154/23/28/55	314	.85 / 1	20.00H/ 27	3.33H/ 7	29.98 / 11	22.75 / 27	18.94 / 27	24.64 / 27	50.55 / 3
154/23/29/27	316	.79 / 2							
154/23/29/43	317	.83 / 1							50.00 / 3
154/23/29/59	318	.75 / 1						24.21 / 4	
154/23/30/15	319	.78 / 1							50.55 / 2
154/23/30/31	320	.79 / 1							
154/23/30/47	321	.78 / 1							
154/23/31/03	322	.78 / 1							
154/23/31/19	323	.78 / 1							
154/23/31/35	324	.79 / 1							
154/23/31/51	325	.77 / 1							
154/23/32/07	326	.78 / 1							
154/23/32/23	327	.81 / 1							
154/23/32/39	328	.78 / 1							
154/23/32/55	329								51.11 / 10
154/23/33/27	331	.79 / 3							
154/23/33/43	332	.78 / 1							
154/23/33/59	333	.78 / 1							
154/23/34/15	334	.77 / 1							
154/23/34/31	335	.78 / 1							
154/23/34/47	336	.78 / 1							
154/23/35/03	337	.78 / 1							
154/23/35/19	338	.78 / 1							51.66 / 9

DATA LISTING PRGRM ERTS-A FLT 8RBIT NB. 0043961A SBURCE NBTR B USB PRBCESSED 23:40 JUN 03,'73 SYSTEM TAPE 022-548 PAGE 28
DATA 8RIGIN 03 JUNE 73 FRBM 22/05/27 (001) TB 23/46/47 (381) CAL 00.00 % BAD 00.01 % SMBBTH SYSTEM TAPE 022-548

TIME DDD/HH/MM/SS	MAJBR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	THO7STI DGC 1/21 7010	PRMBD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS RT T DGC 10/24 16002	SDR FSST DGC 12/25 1224
154/23/35/35	339 1	.78 / 1	20.00H/ 25	3.33H/ 25	29.98 / 25	22.75 / 25	18.94 / 25	24.21 / 21	51.66 / 1
154/23/35/51	340 1	.79 / 1							
154/23/36/07	341 1	.78 / 1							
154/23/36/39	343 1	.76 / 2							
154/23/36/55	344 1	.77 / 1							
154/23/37/11	345 1	.79 / 1							
154/23/37/27	346 1	.77 / 1		3.30H/ 7					
154/23/37/43	347 1	.76 / 1							52.22 / 8
154/23/38/15	349 1	.77 / 2							
154/23/38/31	350 1	.77 / 1							
154/23/38/47	351 1	.78 / 1							
154/23/39/03	352 1	.77 / 1							
154/23/39/19	353 1	.78 / 1							
154/23/39/35	354 1	.77 / 1				23.12 / 15			52.78 / 7
154/23/39/51	355 1	.77 / 1				22.75 / 1			
154/23/40/07	356 1	.78 / 1							
154/23/40/23	357 1	.77 / 1							
154/23/40/39	358 1	.78 / 1				23.12 / 3			
154/23/40/55	359 1	.74 / 1						23.79 / 20	
154/23/41/11	360 1	.75 / 1							53.33 / 6
154/23/41/27	361 1	.78 / 1							
154/23/41/43	362 1	.76 / 1							
154/23/41/59	363 1	.77 / 1							

TIME DDD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	TH07STI DGC 1/21 7010	PRMOD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS RT T DGC 10/24 16002	SDR FSST DGC 12/25 1224
155/01/34/15	25- 1	.78 / 1	20.00H/ 24	3.30L/ 8	29.98 / 3	23.87 / 12	18.39 / 24	23.36 / 1	56.66 / 2
155/01/34/31	26- 1	.77 / 1							
155/01/34/47	27- 1	.77 / 1							
155/01/35/03	28- 1	.89 / 1		4.52L/ 3	32.37H/ 3			23.79 / 3	
155/01/35/19	29- 1	.77 / 1		3.65L/ 1	29.98 / 1	24.25 / 4			
155/01/35/35	30- 1	.76 / 1		3.65H/ 1			18.94 / 5	23.36 / 2	
155/01/35/51	31- 1	.77 / 1							
155/01/36/07	32- 1	.78 / 1			30.28 / 3				
155/01/36/23	33- 1	.79 / 1							57.22 / 8
155/01/36/39	34- 1	.76 / 1			29.98 / 2		18.39 / 4		
155/01/36/55	35- 1	.77 / 1							
155/01/37/11	36- 1	.76 / 1				24.62 / 7			
155/01/37/27	37- 1	.77 / 1							
155/01/37/43	38- 1	.76 / 1							
155/01/37/59	39- 1						18.94 / 5		
155/01/38/15	40- 1	.74 / 2					18.39 / 1		57.78 / 7
155/01/38/31	41- 1	.77 / 1							
155/01/38/47	42- 1			3.67H/ 12	30.28 / 8		18.94 / 2		
155/01/39/03	43- 1	.74 / 2				25.00 / 7	18.39 / 1		
155/01/39/19	44- 1	.74 / 1					18.94 / 1		
155/01/39/35	45- 1	.77 / 1					18.39 / 1		
155/01/39/51	46- 1	.81 / 1		3.30H/ 4					
155/01/40/07	47- 1	.77 / 1							58.33 / 7

DATA LISTING PRGRM ERTS-A FLT ORBIT NO, 0044001A SOURCE NBTR B USB PROCESSED 06:15 JUN 04,'73 SYSTEM TAPE 022-548 PAGE 56
DATA ORIGIN 04 JUNE 73 FROM 04/47/19 (001) TO 06/29/43 (385) CAL 00.04 % BAD 00.04 % SMOOTH SYSTEM TAPE 022-548

TIME DDD/HH/MM/SS	MAJOR FRAME	BAT2 CHG AMP 12/17 6012	RSC T EP MS 15/18 1011	+5V A TMV 18/19 12238	THO7STI DGC 1/21 7010	PRMOD T1 DGC 2/22 6075	LVPS T 2 DGC 8/23 14204	DCS R; T DGC 10/24 16002	SDR FSST DGC 12/25 1224
155/04/47/19	1- 1	.79 / 0	20.00H/ 0	3.33H/ 0	29.98 / 0	23.12 / 0	18.94 / 0	24.21 / 0	52.22 / 0
155/04/47/35	2- 1	.77 / 1							
155/04/47/51	3- 1	.79 / 1			30.28 / 2				
155/04/48/07	4- 1	.78 / 1			29.98 / 1				
155/04/48/23	5- 1	.78 / 1							
155/04/48/39	6- 1	.80 / 1							
155/04/48/55	7- 1	.79 / 1							
155/04/49/11	8- 1	.78 / 1							
155/04/49/27	9- 1	.79 / 1				23.50 / 8			52.78 / 8
155/04/49/43	10- 1	.79 / 1							
155/04/49/59	11- 1	.78 / 1							
155/04/50/15	12- 1	.78 / 1							
155/04/50/47	14- 1	.78 / 2							
155/04/51/03	15- 1								53.33 / 6
155/04/51/19	16- 1	.76 / 2							
155/04/51/35	17- 1	.77 / 1		3.30H/ 16					
155/04/51/51	18- 1	.77 / 1		3.33H/ 1					
155/04/52/07	19- 1	.78 / 1							
155/04/52/23	20- 1	.78 / 1							
155/04/52/55	22- 1	.78 / 2							53.89 / 7
155/04/53/11	23- 1	.74 / 1		3.30H/ 5					
155/04/53/27	24- 1	.78 / 1		4.10H/ 1	32.07H/ 20				
155/04/53/43	25- 1	.77 / 1		3.53H/ 1	29.98 / 1			23.79 / 24	

KTRANS FILE NO. 009 DETAILED COMMAND HISTORY

LINE	MSG	CMD	CMD NAME	GMT/RETR	ETIME	RTIME	ACK	XMIT
010		000 S		01:31:02	00:00:00	00:00:00		
020		766 S	PAYLOADS OFF	01:31:03	01:59:17	00:00:00		VER
030		775 S	ENA USB XMTRS (PRI)	01:31:03	02:53:25	00:00:00		VER
040		000 S		01:31:04	00:00:00	00:00:00		VER
050		605 S	PMP MODULATOR A ON	01:31:04	02:53:27	00:00:00		VER
060		046 S	WPA POWER ON 2	01:31:04	02:54:21	00:00:00		VER
070		525 S	WFM INV A POWER ON	01:31:05	02:54:25	00:00:00		VER
080		023	RED COMSTOR VERIFY	01:31:05				VER
090	183	026	RED COMSTOR ACTVATE	01:31:54			A	
100		026	RED COMSTOR ACTVATE	01:31:55				VER
110	184	922	ALAH 4397 TT	01:35:05TT			A	
120		607	WBVTR 1 ON (PRIM)	01:35:06				VER
130		000	SPARE	01:35:06				VER
140		000	SPARE	01:35:07				VER
150		000	SPARE	01:35:07				VER
160		000	SPARE	01:35:07				VER
170		505	MSS STANDBY 1	01:35:08				VER
180		000	SPARE	01:35:08				VER
190		000	SPARE	01:35:09				VER
200		000	SPARE	01:35:09				VER
210		000	SPARE	01:35:09				VER
220		000	SPARE	01:35:10				VER
230		000	SPARE	01:35:10				VER
240		000	SPARE	01:35:11				VER
250		000	SPARE	01:35:11				VER
260		000	SPARE	01:35:11				VER
270		000	SPARE	01:35:12				VER
280		000	SPARE	01:35:12				VER
290		000	SPARE	01:35:13				VER
300		426	WBR RECORD 1	01:35:13				VER
310	185	848	AUX # 1 ON	01:35:57			A	
320		374	ALL AUX LOADS OFF A	01:35:58				VER
330		000	SPARE	01:35:58				VER
340		000	SPARE	01:35:59				VER
350		000	SPARE	01:35:59				VER
360		000	SPARE	01:35:59				VER
370		356	AUX LOAD 1 ON	01:36:00				VER
380	186	267	BATTERY 2 OFF	01:36:27			A	
390		267	BATTERY 2 OFF	01:36:28				VER

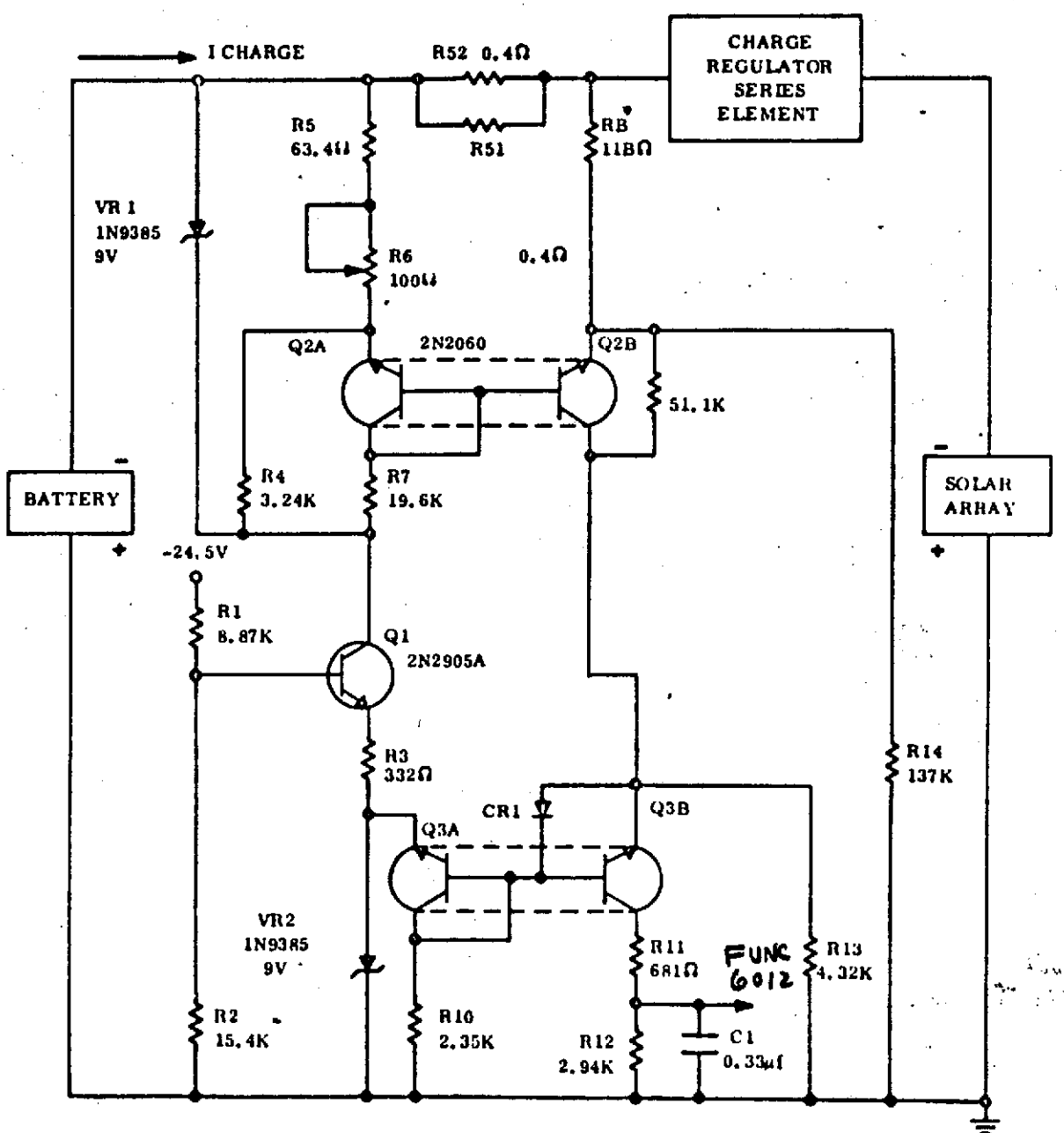
STOP 0

KTRANS FILE NO. 016 DETAILED COMMAND HISTORY PAGE 1

LINE	MSG	CMD		CMD NAME	GMT/RETR	ETIME	RTIME	ACK	XMIT	TLM	DELTA
010	559	840		TIC/TOC SEQUENCE	18:45:48			A			
020		373		VERIFY TICK	18:45:49				VER	VER	
030		000		SPARE	18:45:49				VER		
040		000		SPARE	18:45:50				VER		
050		000		SPARE	18:45:50				VER		
060		000		SPARE	18:45:50				VER		
070		000		SPARE	18:45:51				VER		
080		000		SPARE	18:45:51				VER		
090		457		VERIFY TOCK	18:45:52				VER	VER	
100	560	542		NBR REC 2 P/B MODE	18:46:16			A			
110		542		NBR REC 2 P/B MODE	18:46:17				VER	VER	
120	561	886		ALAH 4407 BCOM	18:46:37			A			
130		021		RED COMSTOR ON/FILL	18:46:38				VER	NON	
140		601	S	NBR REC 2 REC MODE	18:46:38	20:19:20	00:00:00		VER		
150		562	S	NBR REC 1 POWER OFF	18:46:39	20:20:20	00:00:00		VER		
160		052	S	MSS SYSTEM ON	18:46:39	20:25:48	00:00:00		VER		
170		112	S	MSS HI VOLTAGE ON	18:46:39	20:25:50	00:00:00		VER		
180		046	S	WPA POWER ON 2	18:46:40	20:26:04	00:00:00		VER		
190		525	S	WFM INV A POWER ON	18:46:40	20:26:08	00:00:00		VER		
200		775	S	ENA USB XMTRS (PRI)	18:46:41	20:26:38	00:00:00		VER		
210		605	S	PMP MODULATOR A ON	18:46:41	20:26:40	00:00:00		VER		
220		067	S	WPA POWER OFF 2	18:46:41	18:54:52	00:00:00		VER		
230		566	S	WFM INV A POWER OFF	18:46:42	18:54:54	00:00:00		VER		
240		073	S	MSS SYSTEM OFF	18:46:42	18:54:56	00:00:00		VER		
250		000	S		18:46:43	00:00:00	00:00:00		VER		
260		000	S		18:46:43	00:00:00	00:00:00		VER		
270		626	S	PMP MODULATOR A OFF	18:46:43	18:59:00	00:00:00		VER		
280		757	S	DISABLE USB XMTRS	18:46:44	18:59:02	00:00:00		VER		
290		023		RED COMSTOR VERIFY	18:46:44				VER	NON	
300	562	026		RED COMSTOR ACTVATE	18:47:36			A			
310		026		RED COMSTOR ACTVATE	18:47:37				VER	VER	
320	563	353		ALL BATTERIES ON	18:48:06			A			
330		353		ALL BATTERIES ON	18:48:07				VER	VER	
340	564	953		A SUP COM	18:48:35			A			
350		001		PRI COMSTOR ON/FILL	18:48:36				VER	VER	
360		067	S	WPA POWER OFF 2	18:48:36				VER		
370		566	S	WFM INV A POWER OFF	18:48:37				VER		
380		073	S	MSS SYSTEM OFF	18:48:37				VER		
390		626	S	PMP MODULATOR A OFF	18:48:37				VER		
400		757	S	DISABLE USB XMTRS	18:48:38				VER		
410		067	S	WPA POWER OFF 2	18:48:38				VER		
420		566	S	WFM INV A POWER OFF	18:48:39				VER		
430		073	S	MSS SYSTEM OFF	18:48:39				VER		
440		626	S	PMP MODULATOR A OFF	18:48:39				VER		
450		757	S	DISABLE USB XMTRS	18:48:40				VER		
460		000	S	SPARE	18:48:40				VER		
470		000	S	SPARE	18:48:41				VER		
480		162	S	PNEU MOMENTARY ENAB	18:48:41				VER		
490		162	S	PNEU MOMENTARY ENAB	18:48:41				VER		
500		162	S	PNEU MOMENTARY ENAB	18:48:42				VER		

Battery Charge Current (Batteries 1 to 8)

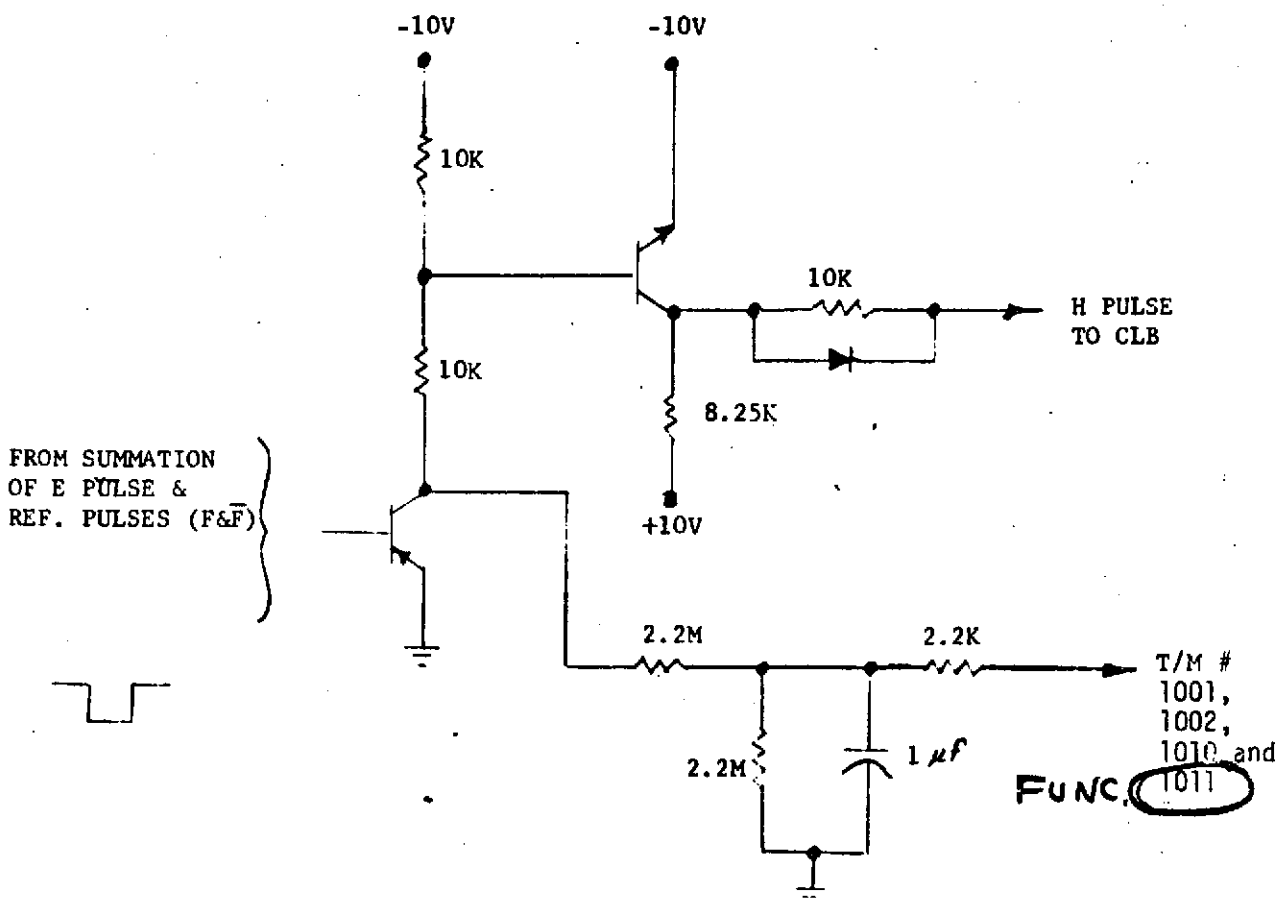
This telemetry circuit senses the battery charge current and converts it into an analog telemetry signal which is linear and has good long-term stability. The calibration is offset a small amount for detection of telemetry failures.



Battery Charge Current Telemetry Derivation

Forward and Rear Scanner Leading and Trailing Earth Pulses

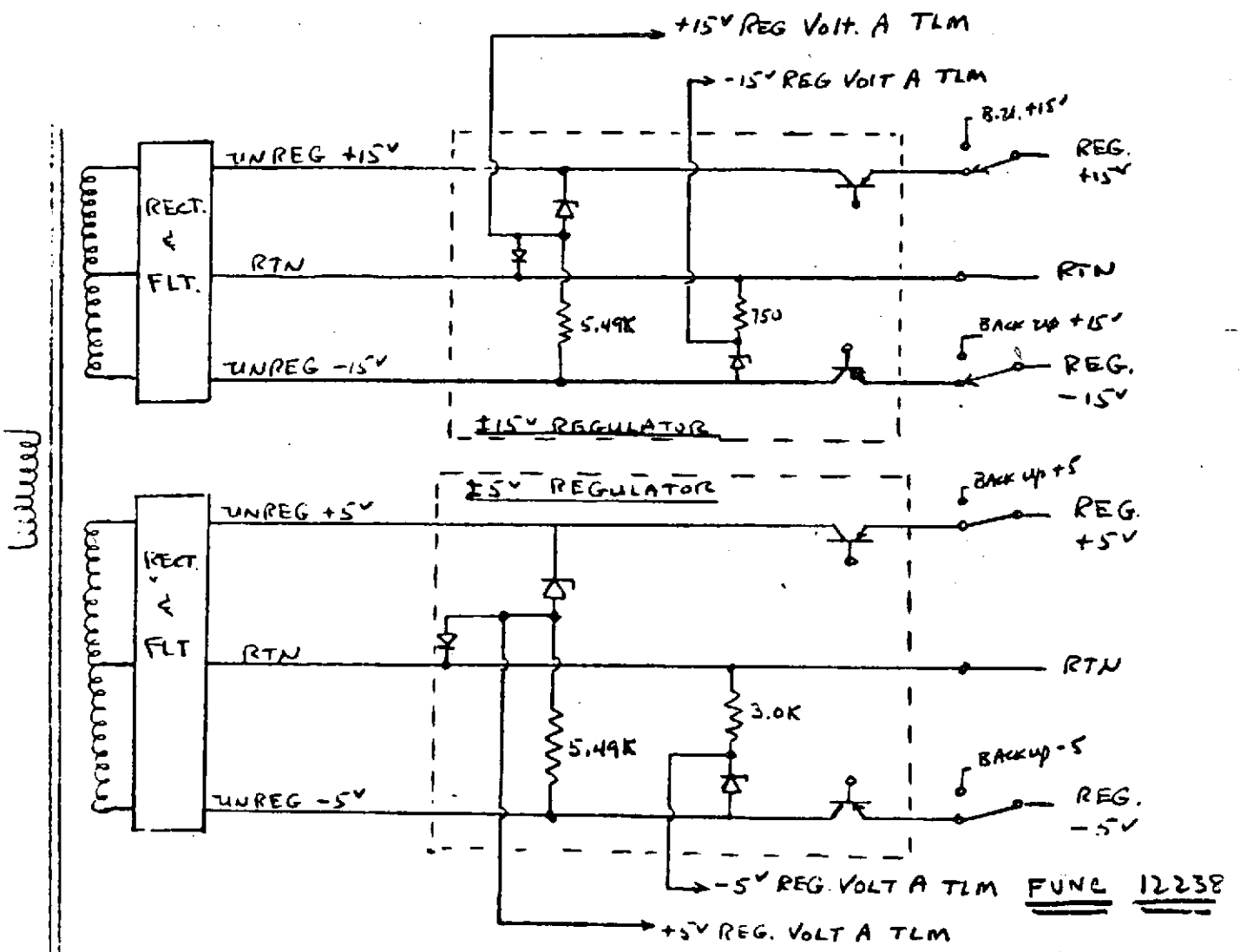
These four telemetry points monitor the leading and trailing earth pulse output from the front and rear scanner circuits. Telemetry output is in terms of duty cycle from 0 to 100 percent.



4.1.6.1.7.2.3 $\pm 15^V$, $\pm 5^V$ Power Supply Output Telemetry

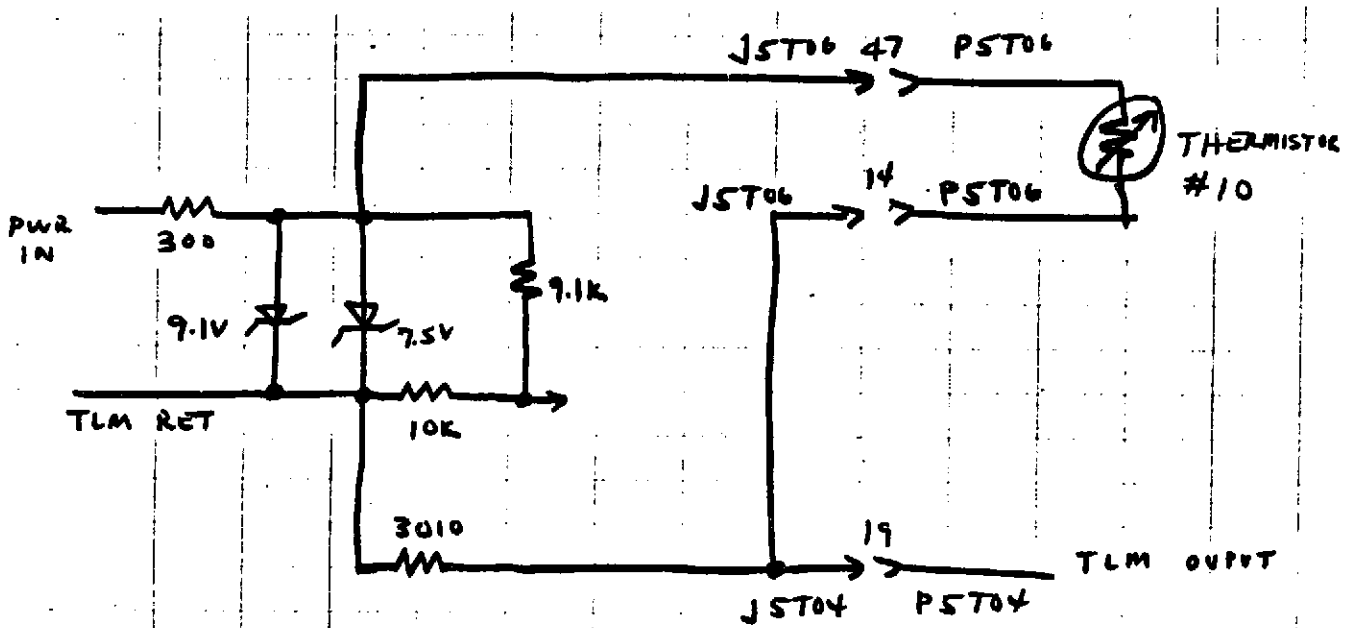
Telemetry points 12232, through 12239 inclusive monitor the unregulated $\pm 15^V$ and $\pm 5^V$ inputs to the regulator circuits for the prime (A) and back-up (B) power supplies.

Out-of-Limits-Criticality-An out of limits indication results from a failure or degradation in the power supply. The alternate supply should be selected for use.



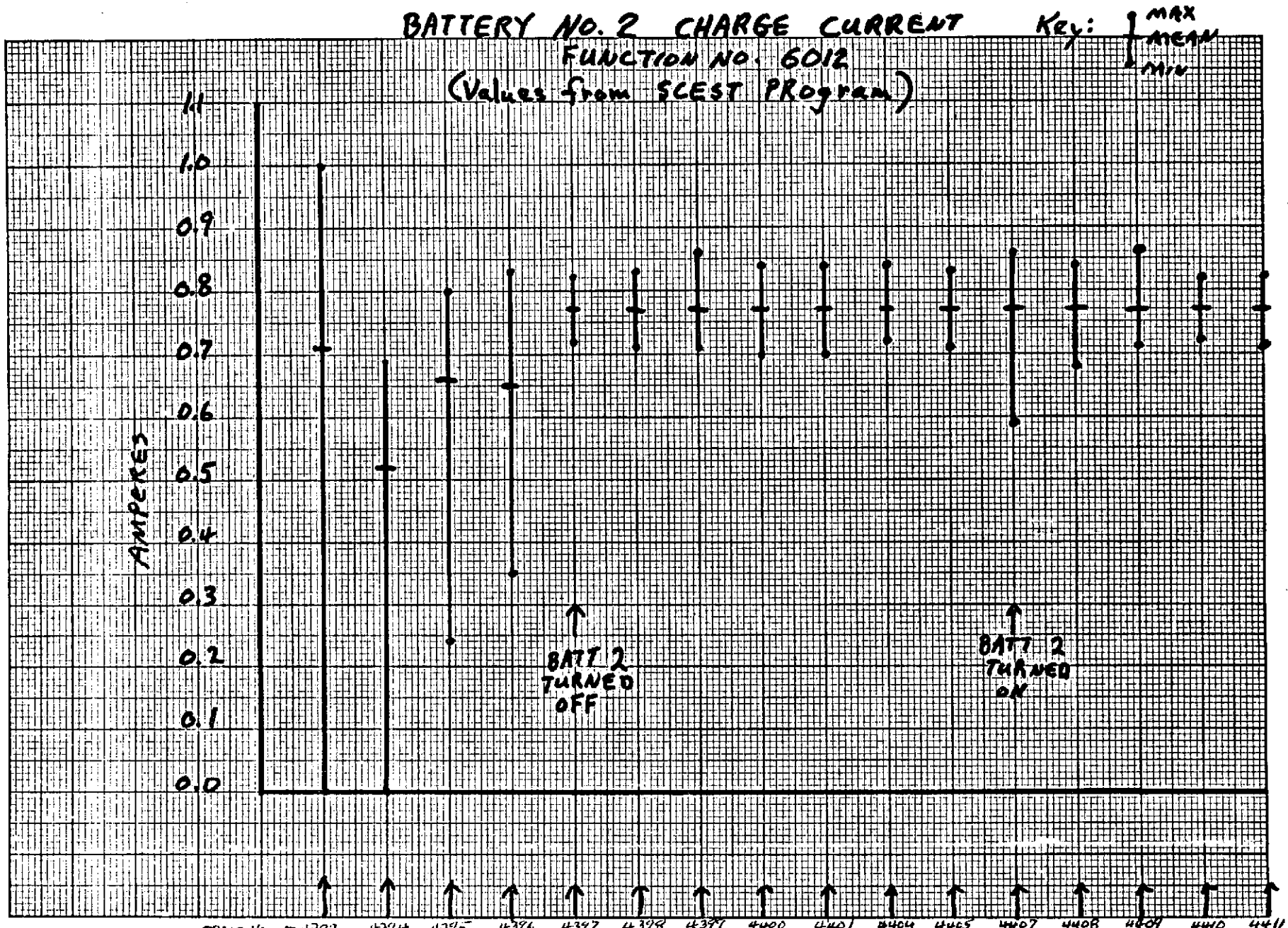
Note: $\pm 15^V$ and $\pm 5^V$ TLM voltages read only when supply is ON.

± 5, ± 15 VOLT PWOER SUPPLY OUTPUT TELEMETRY DERIVATION



FUNCTION 7010, TEMPERATURE SEPARATOR NO 7 TOP INBOARD

6/19/73

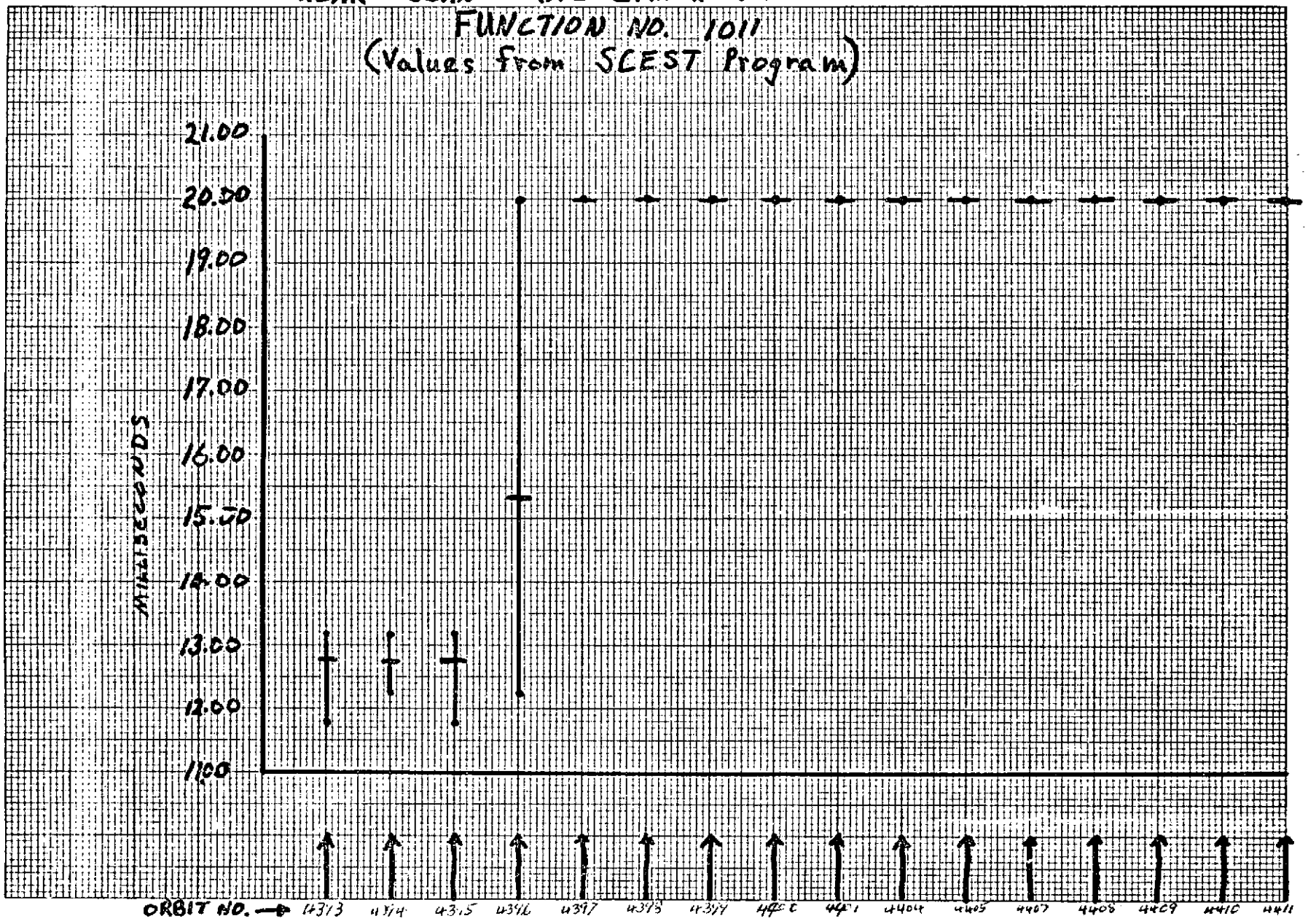

BATTERY NO. 2 CHARGE CURRENT
FUNCTION NO. 6012
(Values from SCEST Program)
Key: MAX MEAN MIN
AMPERES
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
BATT 2 TURNED OFF
BATT 2 TURNED ON
ORBIT No. → 4393 4394 4395 4396 4397 4398 4399 4400 4401 4404 4405 4407 4408 4409 4410 4411

KJC

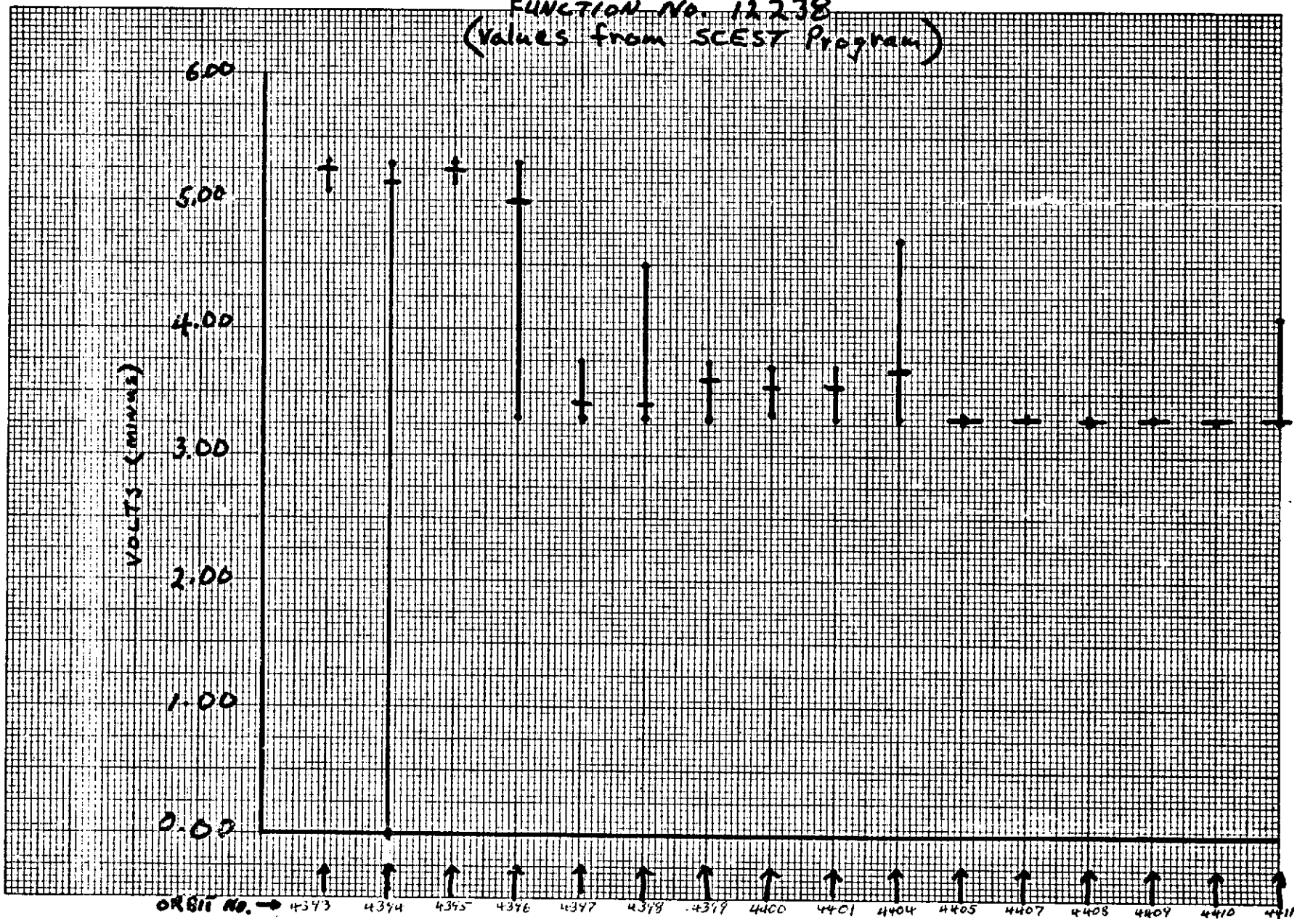
REAR SCAN TRAIL EARTH PULSE

FUNCTION NO. 1011

(Values from SCEST Program)

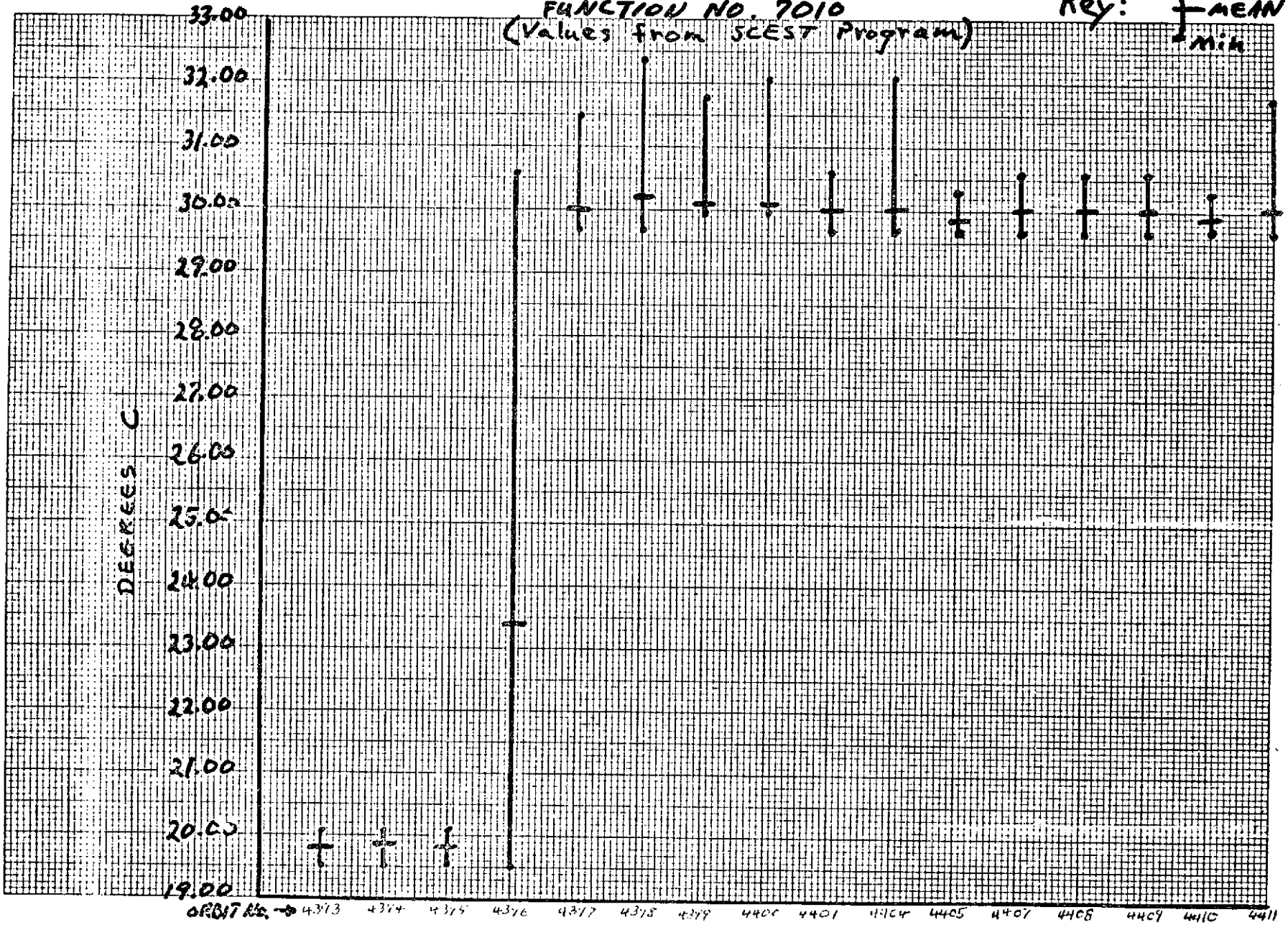


-5 REG. VOLT A
FUNCTION NO. 12238
(Values from SCEST Program)



SEPARATOR NO. 7 TOP INBOARD
FUNCTION NO. 7010
(Values from SCEST Program)

Key: MAX / MEAN / MIN



APPENDIX C

ERTS-1 DCS SUBSYSTEM PERFORMANCE

(PIR 1T23-ERTS-97)

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
PIR NO.	— ERTS — 1T23 — 97			

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
K. S. Rizk/H. Rice	Distribution

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
7/30/73			1) Memo 1H05-490 10/13/72 2) PIR U-1TH4-ERTS-73 3) PIR U-1TH6-ERTS-84

SUBJECT

DCS SUBSYSTEM PERFORMANCE

INFORMATION REQUESTED/RELEASED

Introduction

Since launch, the Data Collection Subsystem has been performing in an excellent manner. External interference periods were described in the 3 references above. Quarterly ERTS Flight Evaluation Reports have reported DCS performance parameters based on a moderate number of data samples. As the spacecraft completes a year's operation and as the system elements have progressively moved from a test phase to a completely operational phase, it is desirable to examine a larger data sample in more detail in order to better define subsystem performance in the following aspects:

a. reception probability
b. system threshold
c. grazing angle effects
d. mutual interference of adjacent DCP's

Discussion

Table 1 shows the time and geometry parameters for 577 messages received recently from 4 Data Collection Platforms (DCP's) within 100 miles of NTTF. The DCP's are:

ID	Loc	User
6114	39.5 N 75.5 W	Paulson
6215	39.7 N 75.5 W	Paulson
6332	39.8 N 75.4 W	Paulson
6360	37.8 N 75.5 W	Kreiger

The data time span is from 8 through 14 July, 1973.

The last two columns labelled "Opportunities" count the number of "time slots" in which a message can be expected by virtue of the fixed interval between messages. Thus, if the preset transmission interval is three minutes, the column labelled "Available" counts the number of three-minute intervals including the first and last message. If in any of these intervals messages were not received from that station, these misses are counted in the column headed "Missed". The ratio of Available-Minus-Missed to Available is then a preliminary measure of the reception probability.

Corrections are applied to this figure. Reception opportunities before the first message received, and after the last message received while the spacecraft is within the DCP horizon

T. W. Winchester
L. Smith Code 430
E. Painter Code 430
J. Seitner U2112
J. Rogers (Beltsville)
R. Crouse
K. Rizk (3) ✓

PAGE NO. ____ OF ____

✓ RETENTION REQUIREMENTS

COPIES FOR	MASTERS FOR
1 MO.	3 MOS.
3 MOS.	8 MOS.
6 MOS.	12 MOS.
MOS.	MOS.
	DO NOT DESTROY

FORM 1020 B REV. (9-70)

are detected in the columns of Table 1, labelled "First Orbit -1" and "Last Oribt +1". These possible missed opportunities could be caused by a) a deficiency in the system; b) the USB transmitter not being ON; or c) ground station antenna masking. To determine if the latter two are applicable explanations, the data are analyzed for USB-ON, and for the applicable masking elevation angle for the ground station receiving antenna at NTTF.

Missed opportunities explainable by these two considerations may then be dismissed as a valid silence. Missed opportunities not thus explained are judged to be a miss--a defect in the subsystem and added to the misses in Table 1. Of the data shown in Table 1, 14 have a clear potential reception interval before the first message received or after the last message received. These are listed in Table 2.

The DCS strip for each of these reception opportunities was examined, together with all other data including trajectory and telemetry. The probable explanation for each is listed in the last column of Table 2.

Four instances of non-receipt of messages are the residual of the study. These do not consider the possible masking of the DCP antennas for which data is not available. There is ample reason to suspect masking of both NTTF antenna (beyond the data available) and DCP antennas by examination of Figure 2, which plots the geographic position of the spacecraft when one of these messages was missed. However, since the data to resolve this is not available, a conservative approach will be taken. All four misses from Table 2 will be added to the two missed from Table 1 to derive a total of six misses in 577 opportunities--a probability of reception of 98.96%.

Of the 131 lines of Table 1 (262 measurements of the slant ranges of the first or last messages), messages were received at slant ranges exceeding 3200 kilometers 14 times. The maximum range observed was 3374 kilometers. It is particularly significant to note that at every opportunity to receive a message within the horizon, the only ones missed were the six listed above, and these six were all between 1500 and 3000 kilometers away. Obviously, the reason for the misses were not distance, since every opportunity (56) to receive a message at distances greater than 3000 kilometers resulted in a valid message reception. The maximum range of reception (or system threshold) may be taken conservatively at 3370 kilometers.

There was no identifiable opportunity to observe grazing angle effect since none of the message intervals permitted this observation. However, prior observations reported in ERTS Quarterly Reports have resulted in the conclusion there is no observable change in the signal at grazing angle geometry.

Of the six misses reported herein, none was displaced by a message from one of the other three adjacent platforms. From this observation and from other observations reported in ERTS Quarterly Reports, there is no discernable interfering effect from nearby DCP's.

Conclusions

Table 3 consolidates the conclusions of this study.

K. S. Rizk

KSR/jwb

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg. -1			First Msg.				Last Msg.				Last Msg. + 1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-8-73	6300	120	5	16	111	9	2587	6	005	4	3137	1			①	8	0
7-8-73	6360			②	185	14	2336	13	339	5	3054	4			②	9	0
7-8-73	6360	048	4	4	060	8	2795	3	079	11	2547	7	105	10	7	3	0
7-8-73	6360			②	013	5	3086	3	195	29	1640	14	195	16	14	8	0
7-8-73	6360			②	346	4	3158	4	277	10	2576	12			②	6	0
7-8-73	6114	124	0	14	109	8	2500	4	009	7	2845	2			①	4	0
7-8-73	6114	184	12	13	203	33	1448	14	339	4	3092	4			②	4	0
7-8-73	6114			①	269	4	3137	13	294	3	3242	7			②	2	0
7-8-73	6114	042	2	4	063	9	2748	3	063	8	2748	3			①	1	0
7-8-73	6114	013	2	3	014	16	2199	8	195	19	2034	14	195	3	14	4	0
7-8-73	6114			①	338	7	2833	4	279	11	2549	11			①	3	0
7-8-73	6215	122	3	15	103	14	2321	8	007	6	2974	1			①	4	0
7-8-73	6215	179	3	13	187	17	2118	13	333	15	2234	1	340	1	5	4	0
7-8-73	6215			①	044	2	3294	4	066	9	2691	3	096	8	12	2	0
7-8-73	6215			①	14	14	2389	9	290	12	2342	7	263	6	13	7	0
7-8-73	6332	120	5	16	099	16	2201	10	006	5	3072	1			①	4	0
7-8-73	6332	183	10	13	199	30	1562	15	337	8	2789	3			①	4	0
7-8-73	6332			①	051	5	3033	4	077	10	2573	6	107	10	6	2	0
7-8-73	6332			①	013	4	3125	3	195	18	2070	14	195	3	14	5	0
7-8-73	6332			②	342	6	2976	5	287	12	2447	10	260	5	13	3	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

C-4

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg. -1			First Msg.				Last Msg.				Last Msg. +1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-9-73	6360	120	7	16	111	13	2399	8	019	14	2312	4	009	8	2	6	0
7-9-73	6360			②	191	16	2183	14	331	15	2283	1	335	8	3	6	0
7-9-73	6360			②	043	3	3190	4	082	13	2425	8	098	12	11	4	0
7-9-73	6360			②	12	5	3067	13	200	16	1988	15			②	9	0
7-9-73	6360			②	344	4	3168	5	277	9	2712	12			②	6	0
7-9-73	6114	124	4	14	104	16	2188	7	005	5	3117	1			①	4	0
7-9-73	6114			②	188	12	2430	14	327	19	2040	1	338	3	4	4	0
7-9-73	6114			②	044	4	3165	4	069	11	2514	3	100	12	9	2	0
7-9-73	6114			①	012	8	2756	3	199	11	2516	15			②	5	0
7-9-73	6114			②	341	5	3045	5	341	5	3045	5			②	1	0
7-9-73	6215	117	2	13	087	22	1890	11	014	11	2512	3	001	1	2	3	0
7-9-73	6215	184	6	13	198	23	1817	15	316	29	1607	3	330	10	0	3	0
7-9-73	6215	033	2	4	062	10	2645	3	062	10	2645	3	91	13	13	1	0
7-9-73	6215			①	12	7	2873	13	199	15	2324	15			②	5	0
7-9-73	6215			①	339	6	2969	4	286	10	2574	10			②	3	0
7-9-73	6332	125	3	14	106	15	2235	7	030	17	2049	4	007	6	1	3	0
7-9-73	6332	184	5	13	196	21	1903	15	332	12	2424	1	340	0	5	4	0
7-9-73	6332	034	1	5	058	8	2735	3	058	8	2735	3	087	13	12	1	0
7-9-73	6332			①	012	6	2873	13	200	16	1988	15			②	5	0
7-9-73	6332			②	343	4	3094	5	290	11	2533	9			②	3	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg. -1			First Msg.				Last Msg.				Last Msg. + 1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-10-73	6360			②	110	15	2200	6	001	2	3200	2			②	8	0
7-10-73	6360			②	195	14	2282	14	338	2	3317	4			②	9	0
7-10-73	6360			②	273	1	3368	13	283	1	3374	11	295	1	8	2	0
7-10-73	6360			②	043	5	3108	4	66	12	2456	3	082	14	9	3	0
7-10-73	6360			②	010	5	3054	2	204	15	2249	14			②	9	0
7-10-73	6360			②	333	6	2913	2	296	10	2600	8			②	4	0
7-10-73	6114	129	3	12	110	15	2255	6	005	7	2797	1	360	0	3	4	0
7-10-73	6114	191	10	14	212	29	1610	11	338	3	3068	3			②	4	0
7-10-73	6114	035	1	4	053	8	2741	4	075	13	2310	4	115	12	6	2	0
7-10-73	6114	010	2	2	008	17	2167	1	206	20	1989	13	202	4	14	4	0
7-10-73	6114	347	2	4	324	07	2740	2	270	5	2999	13			②	4	0
7-10-73	6215	128	3	13	111	15	2209	8	006	11	2799	3			①	4	0
7-10-73	6215	195	14	14	223	35	1423	14	318	23	1878	3	334	6	2	3	0
7-10-73	6215	36	1	4	057	10	2631	3	088	14	2283	12			②	2	0
7-10-73	6215			②	010	05	3012	2	205	16	2174	14			②	5	0
7-10-73	6215			②	340	7	3045	5	284	8	2715	10			②	3	0
7-10-73	6332	124	7	14	100	19	1963	9	002	3	3105	2			②	4	0
7-10-73	6332	193	8	14	207	25	1729	12	332	8	2728	1			①	4	0
7-10-73	6332			②	044	05	3057	4	067	12	2443	3	10	14	2	2	0
7-10-73	6332			②	009	11	2471	2	208	27	1669	13	202	8	14	4	0
7-10-73	6332			②	333	5	2832	2	304	11	2585	6	275	6	12	2	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg. -1			First Msg.				Last Msg.				Last Msg. + 1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-11-73	6360			②	121	13	2400	15	002	5	2928	2			②	7	1
7-11-73	6360			②	197	12	2462	15	335	3	3212	2			②	9	0
7-11-73	6360			②	043	6	2948	4	070	15	2284	3	089	16	12	3	0
7-11-73	6360			②	009	2	3300	2	209	17	3146	13	208	8	13	9	0
7-11-73	6360	335	5	2	332	8	2789	1	269	3	3183	13			②	5	0
7-11-73	6114	105	21	7	057	29	1579	3	005	8	2779	1			①	2	0
7-11-73	6114			①	044	6	2920	4	072	15	2272	3	125	12	14	2	0
7-11-73	6114			①	007	11	2637	1	211	22	1856	12	205	5	14	4	0
7-11-73	6114	346	1	4	325	7	2823	1	270	4	3140	13			②	3	0
7-11-73	6214			②	190	1	2528	13.8	335	3	3175	2			②	5	0
7-11-73	6215	132	3	10	115	16	2154	10	006	9	2679	1			①	4	0
7-11-73	6215	194	9	14	206	25	1727	12	333	6	2958	2			①	4	0
7-11-73	6215			②	042	5	3005	4	067	14	2338	3	102	16	9	2	0
7-11-73	6215			①	008	7	2823	1	207	12	2483	13			②	5	0
7-11-73	6332	129	6	12	109	18	1997	6	004	6	2884	1			①	4	0
7-11-73	6332	192	7	14	206	22	1859	13	331	8	2742	1			①	4	0
7-11-73	6332			②	040	4	3119	4	063	13	2406	3	97	16	11	2	0
7-11-73	6332			①	009	4	3077	2	208	15	2256	3			②	5	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg. -1			First Msg.				Last Msg.				Last Msg. + 1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-12-73	6360			②	130	9	2704	12	001	4	3162	2			②	9	0
7-12-73	6360	203	13	14	214	21	1928	11	333	4	3116	2			①	8	0
7-12-73	6360			②	037	5	3043	4	080	18	2090	7	147	2	17	4	0
7-12-73	6360			②	008	4	3143	1	212	13	2385	11			②	9	0
7-12-73	6360	339	3	4	328	7	2961	1	275	4	3158	12			②	5	0
7-12-73	6114	131	8	11	110	23	1843	6	002	4	3162	2			①	4	0
7-12-73	6114			②	200	10	2571	15	335	2	3342	2			②	5	0
7-12-73	6114			②	035	4	3165	4	059	14	2357	3	94	19	12	2	0
7-12-73	6114			②	008	3	3259	1	230	39	1354	14	212	14	12	4	0
7-12-73	6215	131	8	11	110	23	1843	6	002	5	3053	2			①	4	0
7-12-73	6215			②	200	11	2502	15	335	2	3314	2			②	5	0
7-12-73	6215			①	040	6	2929	4	040	6	2929	4	88	16	11	1	0
7-12-73	6215			①	007	6	2988	1	225	33	1496	14	211	11	11	4	0
7-12-73	6215	339	3	4	316	7	2820	3	288	7	2898	9			②	2	0
7-12-73	6332	002	13	2	117	19	1998	12	004	9	2698	1			①	4	0
7-12-73	6332	191	2	14	205	15	2345	9	298	27	1663	7	325	11	1	3	0
7-12-73	6332			①	039	6	2987	4	102	18	2075	9	102	18	9	3	0
7-12-73	6332	008	4	1	001	20	2015	14	230	39	1354	14	213	14	11	3	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

C-8

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg. -1			First Msg.				Last Msg.				Last Msg. + 1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-13-73	6360	133	10	10	124	18	2079	14	358	4	3159	3			②	8	0
7-13-73	6360			②	209	14	2307	12	324	10	2592	1	331	4	1	7	0
7-13-73	6360			②	037	5	3036	4	97	21	1940	11	127	19	13	5	0
7-13-73	6360			①	006	4	3134	1	222	23	1844	14	216	13	13	5	0
7-13-73	6360	340	2	5	328	5	3060	1	291	5	2996	9			②	4	0
7-13-73	6114	132	10	11	109	27	1670	6	257	2	3307	13			②	4	0
7-13-73	6114	197	4	15	214	17	2130	11	328	7	2892	1			②	4	0
7-13-73	6114			①	038	6	2911	4	064	17	3142	3	104	21	7	2	0
7-13-73	6114			①	003	11	2528	1	221	21	1948	15	212	5	11	4	0
7-13-73	6215	134	9	9.8	113	25	1740	7	360	4	3084	3			①	4	0
7-13-73	6215	195	5	14	212	15	2216	11	326	8	2721	1			①	4	0
7-13-73	6215			①	043	9	2681	4	072	15	2037	3	114	20	10	2	0
7-13-73	6215	007	1	1	002	14	2345	1	220	20	1670	15	211	4	12	4	0
7-13-73	6215	344	8	5	320	6	2948	2	273	4	3360	13			②	3	0
7-13-73	6332	138	3	8	12.5	17	2112	14	257	2	3307	13			②	5	0
7-13-73	6332	207	13	13	239	28	1674	13	322	12	2463	2	335	0	3	3	0
7-13-73	6332			②	031	4	3098	4	095	21	1939	12	132	14	11	3	0
7-13-73	6332			①	003	11	2528	1	222	22	1979	14	212	6	11	4	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

SELECTED DCS MESSAGE RECEPTIONS

July 8 Thru July 14, 1973

		First Msg.-1			First Msg.				Last Msg.				Last Msg.+1			Opportunities	
Date	DCP	Az	El	Masking Angle	Az	El	Range	Masking Angle	Az	El	Range	Masking Angle	Az	El	Masking Angle	Avail	Missed
7-14-73	6360			②	136	10	2500	9	051	39	1319	4	24	30	4	5	0
7-14-73	6360	050	39	4	024	30	1592	4	357	7	3046	3			①	4	0
7-14-73	6360	200	11	15	223	18	2079	14	328	5	2984	14	333	1	2	7	0
7-14-73	6360	030	2	4	038	7	2843	4	139	14	2327	8	149	8	10	7	0
7-14-73	6360			①	005	5	3043	1	227	21	1923	14	220	12	14	8	0
7-14-73	6114			①	137	9	2575	9	009	19	2017	1	356	4	3	4	0
7-14-73	6114	199	3	15	214	13	2344	11	323	9	2691	2			①	4	0
7-14-73	6114			①	041	10	2633	4	145	11	2571	10			②	4	1
7-14-73	6114			①	004	7	2902	1	234	27	1673	14	217	8	13	4	0
7-14-73	6215	142	1	6	134	14	2326	10	356	2	3310	3			②	5	0
7-14-73	6215	207	9	13	233	22	1884	14	331	3	3253	1			①	4	0
7-14-73	6215			②	034	5	3032	4	131	17	2138	12	153	6	16	4	0
7-14-73	6215			①	000	12	2457	3	236	29	1620	13	218	10	13	4	0
7-14-73	6332	138	8	8	121	25	1753	15	359	7	2823	3			①	4	0
7-14-73	6332	210	11	12	239	24	1802	13	319	12	2475	3	330	1	0	3	0
7-14-73	6332	028	0	4	042	10	2804	4	145	11	2542	10			②	4	0
7-14-73	6332	005	4	1	356	18	2069	3	222	15	2298	14			②	4	0

① SPACECRAFT BELOW HORIZON.

② ADJACENT RECEIVED MSG NEAR MARGINAL ELEVATION ANGLE. FURTHER ANALYSIS NOT REQUIRED.

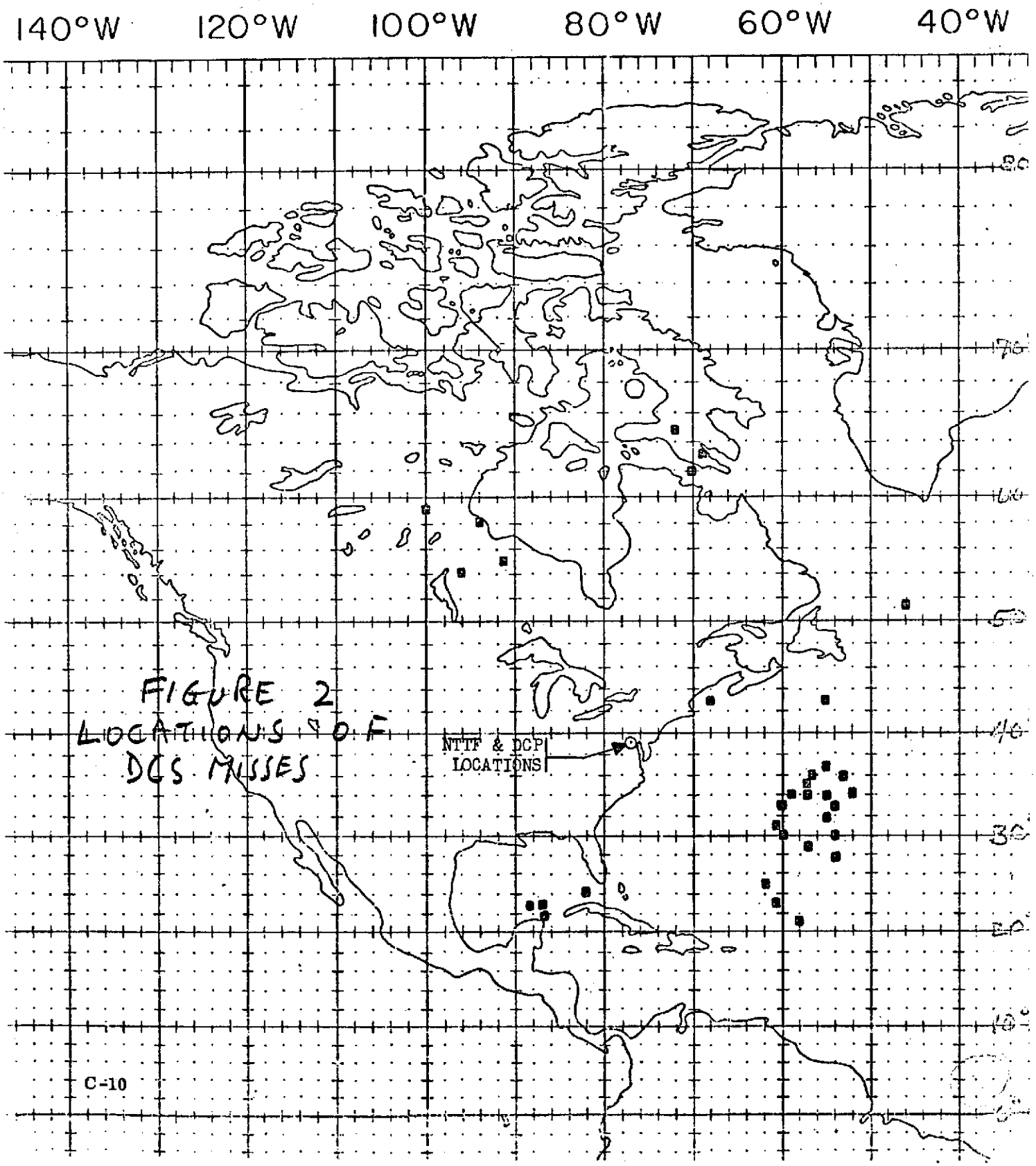


FIGURE 2
LOCATIONS OF
DCS MISSES

TABLE 2

ADDITIONAL POTENTIAL DCS MISSES

	Date	Time	DCP	Apparent Explanation
1	9 July	01 16 25		Noise in DCS System
2	9 July	02 58 29		Noise in DCS System
3	10 July	13 47 31	6360	None
4	10 July	13 49 09	6332	Bad station time input
5	10 July	13 50 32	6114	Noise at DCS receiver
6	11 July	01 19 58	6114	None
7	11 July	13 54 46		Bad station time input
8	12 July	01 21 52	6332	USB off
9	12 July	03 14 51	6332	None
10	12 July	13 59 51	6114	Noise in DCS System
11	12 July	14 03 26	6332	Bad station time input
12	13 July	14 03 48	6215	Noise in DCS System
13	13 July	14 06 04	6114	None
14	13 July	14 07 07	6360	Bad station time input

TABLE 3

DCS SUBSYSTEM PERFORMANCE

Reception Probability	98.96%
System Threshold	3370 Km.
Grazing Angle Effects	Not Discernable
Mutual Interference of Adjacent DCP's	Not Seen

APPENDIX D

ERTS-1 TELEMETRY MATRIX LOCATION TABLE

Page intentionally left blank

APPENDIX E

ERTS-1 GROUND TRACE REPEAT CYCLE PREDICTIONS TABLE

JULY 1972

Date	GMT Day	Flight Day	Spacecraft Orbit	Reference Orbit	Ref Day	Cycle
23	205	0	0-3	150-153	11	
24	206	1	4-17	154-167	12	
25	207	2	18-31	168-181	13	
26	208	3	32-45	168-181*	13	
27	209	4	46-59	182-195	14	0th
28	210	5	60-73	196-209	15	
29	211	6	74-87	210-223	16	
30	212	7	88-101	224-237	17	
31	213	8	102-115	238-251	18	

*Shift due to initial orbit (prior to orbit adjustments)

AUGUST 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	214	9	116-129	1-14	1	
2	215	10	130-143	15-28	2	
3	216	11	144-157	29-42	3	
4	217	12	158-171	43-56	4	
5	218	13	172-185	57-70	5	
6	219	14	186-199	71-84	6	
7	220	15	200-213	85-98	7	
8	221	16	214-226	99-111	8	
9	222	17	227-240	112-125	9	
10	223	18	241-254	126-139	10	1st
11	224	19	255-268	140-153	11	
12	225	20	269-282	154-167	12	
13	226	21	283-296	168-181	13	
14	227	22	297-310	182-195	14	
15	228	23	311-324	196-209	15	
16	229	24	325-338	210-223	16	
17	230	25	339-352	224-237	17	
18	231	26	353-366	238-251	18	
19	232	27	367-380	1-14	1	
20	233	28	381-394	15-28	2	
21	234	29	395-408	29-42	3	
22	235	30	409-422	43-56	4	
23	236	31	423-436	57-70	5	
24	237	32	437-450	71-84	6	
25	238	33	451-464	85-98	7	
26	239	34	465-478	99-111	8	
27	240	35	479-491	112-125	9	
28	241	36	492-505	126-139	10	
29	242	37	506-519	140-153	11	
30	243	38	520-533	154-167	12	
31	244	39	534-547	168-181	13	2nd

SEPTEMBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	245	40	548-561	182-195	14	2nd ↓
2	246	41	562-575	196-209	15	
3	247	42	576-589	210-223	16	
4	248	43	590-603	224-237	17	
5	249	44	604-617	238-251	18	
6	250	45	618-631	1-14	1	↑
7	251	46	632-645	15-28	2	
8	252	47	646-659	29-42	3	
9	253	48	660-673	43-56	4	
10	254	49	674-687	57-70	5	
11	255	50	688-701	71-84	6	
12	256	51	702-715	85-98	7	
13	257	52	716-728	99-111	8	
14	258	53	729-742	112-125	9	
15	259	54	743-756	126-139	10	3rd
16	260	55	757-770	140-153	11	
17	261	56	771-784	154-167	12	
18	262	57	785-798	168-181	13	
19	263	58	799-812	182-195	14	
20	264	59	813-826	196-209	15	
21	265	60	827-840	210-223	16	
22	266	61	841-854	224-237	17	
23	267	62	855-868	238-251	18	↓
24	268	63	869-882	1-14	1	↑
25	269	64	883-896	15-28	2	
26	270	65	897-910	29-42	3	
27	271	66	911-924	43-56	4	
28	272	67	925-938	57-70	5	
29	273	68	939-952	71-84	6	
30	274	69	953-966	85-98	7	4th

OCTOBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	275	70	967-979	99-111	8	4th
2	276	71	980-993	112-125	9	
3	277	72	994-1007	126-139	10	
4	278	73	1008-1021	140-153	11	
5	279	74	1022-1035	154-167	12	
6	280	75	1036-1049	168-181	13	
7	281	76	1050-1063	182-195	14	
8	282	77	1064-1077	196-209	15	
9	283	78	1078-1091	210-223	16	
10	284	79	1092-1105	224-237	17	
11	285	80	1106-1119	238-251	18	
12	286	81	1120-1133	1-14	1	5th
13	287	82	1134-1147	15-28	2	
14	288	83	1148-1161	29-42	3	
15	289	84	1162-1175	43-56	4	
16	290	85	1176-1189	57-70	5	
17	291	86	1190-1203	71-84	6	
18	292	87	1204-1217	85-98	7	
19	293	88	1218-1230	99-111	8	
20	294	89	1231-1244	112-125	9	
21	295	90	1245-1258	126-139	10	
22	296	91	1259-1272	140-153	11	
23	297	92	1273-1286	154-167	12	
24	298	93	1287-1300	168-181	13	
25	299	94	1301-1314	182-195	14	
26	300	95	1315-1328	196-209	15	
27	301	96	1329-1342	210-223	16	
28	302	97	1343-1356	224-237	17	
29	303	98	1357-1370	238-251	18	
30	304	99	1371-1384	1-14	1	6th
31	305	100	1385-1393	15-28	2	

NOVEMBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	306	101	1399-1412	29-42	3	6th
2	307	102	1413-1426	43-56	4	
3	308	103	1427-1440	57-70	5	
4	309	104	1441-1454	71-84	6	
5	310	105	1455-1468	85-98	7	
6	311	106	1469-1481	99-111	8	
7	312	107	1482-1495	112-125	9	
8	313	108	1496-1509	126-139	10	
9	314	109	1510-1523	140-153	11	
10	315	110	1524-1537	154-167	12	
11	316	111	1538-1551	168-181	13	
12	317	112	1552-1565	182-195	14	
13	318	113	1566-1579	196-209	15	
14	319	114	1580-1593	210-223	16	
15	320	115	1594-1607	224-237	17	
16	321	116	1608-1621	238-251	18	
17	322	117	1622-1635	1-14	1	7th
18	323	118	1636-1649	15-28	2	
19	324	119	1650-1663	29-42	3	
20	325	120	1664-1677	43-56	4	
21	326	121	1678-1691	57-70	5	
22	327	122	1692-1705	71-84	6	
23	328	123	1706-1719	85-98	7	
24	329	124	1720-1732	99-111	8	
25	330	125	1733-1746	112-125	9	
26	331	126	1747-1760	126-139	10	
27	332	127	1761-1774	140-153	11	
28	333	128	1775-1788	154-167	12	
29	334	129	1789-1802	168-181	13	
30	335	130	1803-1816	182-195	14	

DECEMBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	336	131	1817-1830	196-209	15	7th ↓
2	337	132	1831-1844	210-223	16	
3	338	133	1845-1858	224-237	17	
4	339	134	1859-1872	238-251	18	
5	340	135	1873-1886	1-14	1	↑
6	341	136	1887-1900	15-28	2	
7	342	137	1901-1914	29-42	3	
8	343	138	1915-1928	43-56	4	
9	344	139	1929-1942	57-70	5	
10	345	140	1943-1956	71-84	6	
11	346	141	1957-1970	85-98	7	
12	347	142	1971-1983	99-111	8	
13	348	143	1984-1997	112-125	9	
14	349	144	1998-2011	126-139	10	8th
15	350	145	2012-2025	140-153	11	
16	351	146	2026-2039	154-167	12	
17	352	147	2040-2053	168-181	13	
18	353	148	2054-2067	182-195	14	
19	354	149	2068-2081	196-209	15	
20	355	150	2082-2095	210-223	16	
21	356	151	2096-2109	224-237	17	
22	357	152	2110-2123	238-251	18	↓
23	358	153	2124-2137	1-14	1	↑
24	359	154	2138-2151	15-28	2	
25	360	155	2152-2165	29-42	3	
26	361	156	2166-2179	43-56	4	
27	362	157	2180-2193	57-70	5	
28	363	158	2194-2207	71-84	6	
29	364	159	2208-2221	85-98	7	
30	365	160	2222-2234	99-111	8	
31	366	161	2235-2248	112-125	9	9th

JANUARY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	1	162	2249-2262	126-139	10	9th
2	2	163	2263-2276	140-153	11	
3	3	164	2277-2290	154-167	12	
4	4	165	2291-2304	168-181	13	
5	5	166	2305-2318	182-195	14	
6	6	167	2319-2332	196-209	15	
7	7	168	2333-2346	210-223	16	
8	8	169	2347-2360	224-237	17	
9	9	170	2361-2374	238-251	18	
10	10	171	2375-2388	1-14	1	
11	11	172	2389-2402	15-28	2	
12	12	173	2403-2416	29-42	3	
13	13	174	2417-2430	43-56	4	
14	14	175	2431-2444	57-70	5	
15	15	176	2445-2458	71-84	6	
16	16	177	2459-2472	85-98	7	
17	17	178	2473-2485	99-111	8	
18	18	179	2486-2499	112-125	9	
19	19	180	2500-2513	126-139	10	10th
20	20	181	2514-2527	140-153	11	
21	21	182	2528-2541	154-167	12	
22	22	183	2542-2555	168-181	13	
23	23	184	2556-2569	182-195	14	
24	24	185	2570-2583	196-209	15	
25	25	186	2584-2597	210-223	16	
26	26	187	2598-2611	224-237	17	
27	27	188	2612-2625	238-251	18	
28	28	189	2626-2639	1-14	1	
29	29	190	2640-2653	15-28	2	
30	30	191	2654-2667	29-42	3	
31	31	192	2668-2681	43-56	4	11th

FEBRUARY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	32	193	2682-2695	57-70	5	11th
2	33	194	2696-2709	71-84	6	
3	34	195	271-2723	85-98	7	
4	35	196	2724-2736	99-111	8	
5	36	197	2737-2750	112-125	9	
6	37	198	2751-2764	126-139	10	
7	38	199	2765-2778	140-153	11	
8	39	200	2779-2792	154-167	12	
9	40	201	2793-2806	168-181	13	
10	41	202	2807-2820	182-195	14	
11	42	203	2821-2834	196-209	15	
12	43	204	2835-2848	210-223	16	
13	44	205	2849-2862	224-237	17	
14	45	206	2863-2876	238-251	18	
15	46	207	2877-2890	1-14	1	
16	47	208	2891-2904	15-28	2	
17	48	209	2905-2918	29-42	3	
18	49	210	2919-2932	43-56	4	
19	50	211	2933-2946	57-70	5	
20	51	212	2947-2960	71-84	6	
21	52	213	2961-2974	85-98	7	
22	53	214	2975-2987	99-111	8	
23	54	215	2988-3001	112-125	9	
24	55	216	3002-3015	126-139	10	
25	56	217	3016-3029	140-153	11	
26	57	218	3030-3043	154-167	12	
27	58	219	3044-3057	168-181	13	
28	59	220	3058-3071	182-195	14	12th

MARCH 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	60	221	3072-3085	196-209	15	12th
2	61	222	3086-3099	210-223	16	
3	62	223	3100-3113	224-237	17	
4	63	224	3114-3127	238-251	18	
5	64	225	3128-3141	1-14	1	
6	65	226	3142-3155	15-28	2	
7	66	227	3156-3169	29-42	3	
8	67	228	3170-3183	43-56	4	
9	68	229	3184-3197	57-70	5	
10	69	230	3198-3211	71-84	6	
11	70	231	3212-3225	85-98	7	
12	71	232	3226-3238	99-111	8	
13	72	233	3239-3252	112-125	9	
14	73	234	3253-3266	126-139	10	13th
15	74	235	3267-3280	140-153	11	
16	75	236	3281-3294	154-167	12	
17	76	237	3295-3308	168-181	13	
18	77	238	3309-3322	182-195	14	
19	78	239	3323-3336	196-209	15	
20	79	240	3337-3350	210-223	16	
21	80	241	3351-3364	224-237	17	
22	81	242	3365-3378	238-251	18	
23	82	243	3379-3392	1-14	1	
24	83	244	3393-3406	15-28	2	
25	84	245	3407-3420	29-42	3	
26	85	246	3421-3434	43-56	4	
27	86	247	3435-3448	57-70	5	
28	87	248	3449-3462	71-84	6	
29	88	249	3463-3476	85-98	7	
30	89	250	3477-3489	99-111	8	
31	90	251	3490-3503	112-125	9	14th

APRIL 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	91	252	3504-3517	126-139	10	14th
2	92	253	3518-3531	140-153	11	
3	93	254	3532-3545	154-167	12	
4	94	255	3546-3559	168-181	13	
5	95	256	3560-3573	182-195	14	
6	96	257	3574-3587	196-209	15	
7	97	258	3588-3601	210-223	16	
8	98	259	3602-3615	224-237	17	
9	99	260	3616-3629	238-251	18	
10	100	261	3630-3643	1-14	1	
11	101	262	3644-3657	15-28	2	
12	102	263	3658-3671	29-42	3	
13	103	264	3672-3685	43-56	4	
14	104	265	3686-3699	57-70	5	
15	105	266	3700-3713	71-84	6	
16	106	267	3714-3727	85-98	7	
17	107	268	3728-3740	99-111	8	
18	108	269	3741-3754	112-125	9	
19	109	270	3755-3768	126-139	10	15th
20	110	271	3769-3782	140-153	11	
21	111	272	3783-3796	154-167	12	
22	112	273	3797-3810	168-181	13	
23	113	274	3811-3824	182-195	14	
24	114	275	3825-3838	196-209	15	
25	115	276	3839-3852	210-223	16	
26	116	277	3853-3866	224-237	17	
27	117	278	3867-3880	238-251	18	
28	118	279	3881-3894	1-14	1	
29	119	280	3895-3908	15-28	2	
30	120	281	3909-3922	29-42	3	16th

MAY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	121	282	3923-3936	43-56	4	16th
2	122	283	3937-3950	57-70	5	
3	123	284	3951-3964	71-84	6	
4	124	285	3965-3978	85-98	7	
5	125	286	3979-3991	99-111	8	
6	126	287	3992-4005	112-125	9	
7	127	288	4006-4019	126-139	10	
8	128	289	4020-4033	140-153	11	
9	129	290	4034-4047	154-167	12	
10	130	291	4048-4061	168-181	13	
11	131	292	4062-4075	182-195	14	
12	132	293	4076-4089	196-209	15	
13	133	294	4090-4103	210-223	16	
14	134	295	4104-4117	224-237	17	
15	135	296	4118-4131	238-251	18	
16	136	297	4132-4145	1-14	1	
17	137	298	4146-4159	15-28	2	
18	138	299	4160-4173	29-42	3	
19	139	300	4174-4187	43-56	4	
20	140	301	4188-4201	57-70	5	
21	141	302	4202-4215	71-84	6	
22	142	303	4216-4229	85-98	7	
23	143	304	4230-4242	99-111	8	
24	144	305	4243-4256	112-125	9	
25	145	306	4257-4270	126-139	10	
26	146	307	4271-4284	140-153	11	
27	147	308	4285-4298	154-167	12	
28	148	309	4299-4312	168-181	13	
29	149	310	4313-4326	182-195	14	
30	150	311	4327-4340	196-209	15	
31	151	312	4341-4354	210-223	16	17th

JUNE 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	152	313	4355-4368	224-237	17	17th ↓
2	153	314	4369-4382	238-251	18	
3	154	315	4383-4396	1-14	1	↑
4	155	316	4397-4410	15-28	2	
5	156	317	4411-4424	29-42	3	
6	157	318	4425-4438	43-56	4	
7	158	319	4439-4452	57-70	5	
8	159	320	4453-4466	71-84	6	
9	160	321	4467-4480	85-98	7	
10	161	322	4481-4493	99-111	8	
11	162	323	4494-4507	112-125	9	18th
12	163	324	4508-4521	126-139	10	
13	164	325	4522-4535	140-153	11	
14	165	326	4536-4549	154-167	12	
15	166	327	4550-4563	168-181	13	
16	167	328	4564-4577	182-195	14	
17	168	329	4578-4591	196-209	15	
18	169	330	4592-4605	210-223	16	
19	170	331	4606-4619	224-237	17	
20	171	332	4620-4633	238-251	18	↓
21	172	333	4634-4647	1-14	1	
22	173	334	4648-4661	15-28	2	↑
23	174	335	4662-4675	29-42	3	
24	175	336	4676-4689	43-56	4	
25	176	337	4690-4703	57-70	5	
26	177	338	4704-4717	71-84	6	
27	178	339	4718-4731	85-98	7	
28	179	340	4732-4744	99-111	8	
29	180	341	4745-4758	112-125	9	
30	181	342	4759-4772	126-139	10	19th

JULY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	343	4773-4786	140-153	11	19th
2	183	344	4787-4800	154-167	12	
3	184	345	4801-4814	168-181	13	
4	185	346	4815-4828	182-195	14	
5	186	347	4829-4842	196-209	15	
6	187	348	4843-4856	210-223	16	
7	188	349	4857-4870	224-237	17	
8	189	350	4871-4884	238-251	18	
9	190	351	4885-4898	1-14	1	20th
10	191	352	4899-4912	15-28	2	
11	192	353	4913-4926	29-42	3	
12	193	354	4927-4940	43-56	4	
13	194	355	4941-4954	57-70	5	
14	195	356	4955-4968	71-84	6	
15	196	357	4969-4982	85-98	7	
16	197	358	4983-4995	99-111	8	
17	198	359	4996-5009	112-125	9	
18	199	360	5010-5023	126-139	10	
19	200	361	5024-5037	140-153	11	
20	201	362	5038-5051	154-167	12	
21	202	363	5052-5065	168-181	13	
22	203	364	5066-5079	182-195	14	
23	204	365	5080-5093	196-209	15	
24	205	366	5094-5107	210-223	16	
25	206	367	5108-5121	224-237	17	
26	207	368	5122-5135	238-251	18	
27	208	369	5136-5149	1-14	1	21st
28	209	370	5150-5163	15-28	2	
29	210	371	5164-5177	29-42	3	
30	211	372	5178-5191	43-56	4	
31	212	373	5192-5205	57-70	5	

AUGUST 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	374	5206-5219	71-84	6	21st
2	214	375	5220-5233	85-98	7	
3	215	376	5234-5246	99-111	8	
4	216	377	5247-5260	112-125	9	
5	217	378	5261-5274	126-139	10	
6	218	379	5275-5288	140-153	11	
7	219	380	5289-5302	154-167	12	
8	220	381	5303-5316	168-181	13	
9	221	382	5317-5330	182-195	14	
10	222	383	5331-5344	196-209	15	
11	223	384	5345-5358	210-223	16	
12	224	385	5359-5372	224-237	17	
13	225	386	5373-5386	238-251	18	
14	226	387	5387-5400	1-14	1	22nd
15	227	388	5401-5414	15-28	2	
16	228	389	5415-5428	29-42	3	
17	229	390	5429-5442	43-56	4	
18	230	391	5443-5456	57-70	5	
19	231	392	5457-5470	71-84	6	
20	232	393	5471-5484	85-98	7	
21	233	394	5485-5497	99-111	8	
22	234	395	5498-5511	112-125	9	
23	235	396	5512-5525	126-139	10	
24	236	397	5526-5539	140-153	11	
25	237	398	5540-5553	154-167	12	
26	238	399	5554-5567	168-181	13	
27	239	400	5568-5581	182-195	14	
28	240	401	5582-5595	196-209	15	
29	241	402	5596-5609	210-223	16	
30	242	403	5610-5623	224-237	17	
31	243	404	5624-5637	238-251	18	

SEPTEMBER 1973

DAY	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	405	5638-5651	1-14	1	23rd
2	245	406	5652-5665	15-28	2	
3	246	407	5666-5679	29-42	3	
4	247	408	5680-5693	43-56	4	
5	248	409	5694-5707	57-70	5	
6	249	410	5708-5721	71-84	6	
7	250	411	5722-5735	85-98	7	
8	251	412	5736-5748	99-111	8	
9	252	413	5749-5762	112-125	9	
10	253	414	5763-5776	126-139	10	
11	254	415	5777-5790	140-153	11	
12	255	416	5791-5804	154-167	12	
13	256	417	5805-5818	168-181	13	
14	257	418	5819-5832	182-195	14	
15	258	419	5833-5846	196-209	15	
16	259	420	5847-5860	210-223	16	
17	260	421	5861-5874	224-237	17	
18	261	422	5875-5888	238-251	18	
19	262	423	5889-5902	1-14	1	24th
20	263	424	5903-5916	15-28	2	
21	264	425	5917-5930	29-42	3	
22	265	426	5931-5944	43-56	4	
23	266	427	5945-5958	57-70	5	
24	267	428	5959-5972	71-84	6	
25	268	429	5973-5986	85-98	7	
26	269	430	5987-5999	99-111	8	
27	270	431	6000-6013	112-125	9	
28	271	432	6014-6027	126-139	10	
29	272	433	6028-6041	140-153	11	
30	273	434	6042-6055	154-167	12	

OCTOBER 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	435	6056-6069	168-181	13	24th
2	275	436	6070-6083	182-195	14	
3	276	437	6084-6097	196-209	15	
4	277	438	6098-6111	210-223	16	
5	278	439	6112-6125	224-237	17	
6	279	440	6126-6139	238-251	18	
7	280	441	6140-6153	1-14	1	
8	281	442	6154-6167	15-28	2	
9	282	443	6168-6181	29-42	3	
10	283	444	6182-6195	43-56	4	
11	284	445	6196-6209	57-70	5	
12	285	446	6210-6223	71-84	6	
13	286	447	6224-6237	85-98	7	
14	287	448	6238-6250	99-111	8	
15	288	449	6251-6264	112-125	9	25th
16	289	450	6265-6278	126-139	10	
17	290	451	6279-6292	140-153	11	
18	291	452	6293-6306	154-167	12	
19	292	453	6307-6320	168-181	13	
20	293	454	6321-6334	182-195	14	
21	294	455	6335-6348	196-209	15	
22	295	456	6349-6362	210-223	16	
23	296	457	6363-6376	224-237	17	
24	297	458	6377-6390	238-251	18	
25	298	459	6391-6404	1-14	1	26th
26	299	460	6405-6418	15-28	2	
27	300	461	6419-6432	29-42	3	
28	301	462	6433-6446	43-56	4	
29	302	463	6447-6460	57-70	5	
30	303	464	6461-6474	71-84	6	
31	304	465	6475-6488	85-98	7	

NOVEMBER 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	466	6489-6501	99-111	8	26th
2	306	467	6502-6515	112-125	9	
3	307	468	6516-6529	126-139	10	
4	308	469	6530-6543	140-153	11	
5	309	470	6544-6557	154-167	12	
6	310	471	6558-6571	168-181	13	
7	311	472	6572-6585	182-195	14	
8	312	473	6586-6599	196-209	15	
9	313	474	6600-6613	210-223	16	
10	314	475	6614-6627	224-237	17	
11	315	476	6628-6641	238-251	18	
12	316	477	6642-6655	1-14	1	27th
13	317	478	6656-6669	15-28	2	
14	318	479	6670-6683	29-42	3	
15	319	480	6684-6697	43-56	4	
16	320	481	6698-6711	57-70	5	
17	321	482	6712-6725	71-84	6	
18	322	483	6726-6739	85-98	7	
19	323	484	6740-6752	99-111	8	
20	324	485	6753-6766	112-125	9	
21	325	486	6767-6780	126-139	10	
22	326	487	6781-6794	140-153	11	
23	327	488	6795-6808	154-167	12	
24	328	489	6809-6822	168-181	13	
25	329	490	6823-6836	182-195	14	
26	330	491	6837-6850	196-209	15	
27	331	492	6851-6864	210-223	16	
28	332	493	6865-6878	224-237	17	
29	333	494	6879-6892	238-251	18	
30	334	495	6893-6906	1-14	1	28th

DECEMBER 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	496	6907-6920	15-28	2	28th
2	336	497	6921-6934	29-42	3	
3	337	498	6935-6948	43-56	4	
4	338	499	6949-6962	57-70	5	
5	339	500	6963-6976	71-84	6	
6	340	501	6977-6990	85-98	7	
7	341	502	6991-7003	99-111	8	
8	342	503	7004-7017	112-125	9	
9	343	504	7018-7031	126-139	10	
10	344	505	7032-7045	140-153	11	
11	345	506	7046-7059	154-167	12	
12	346	507	7060-7073	168-181	13	
13	347	508	7074-7087	182-195	14	
14	348	509	7088-7101	196-209	15	
15	349	510	7102-7115	210-223	16	
16	350	511	7116-7129	224-237	17	
17	351	512	7130-7143	238-251	18	
18	352	513	7144-7157	1-14	1	29th
19	353	514	7158-7171	15-28	2	
20	354	515	7172-7185	29-42	3	
21	355	516	7186-7199	43-56	4	
22	356	517	7200-7213	57-70	5	
23	357	518	7214-7227	71-84	6	
24	358	519	7228-7241	85-98	7	
25	359	520	7242-7254	99-111	8	
26	360	521	7255-7268	112-125	9	
27	361	522	7269-7282	126-139	10	
28	362	523	7283-7296	140-153	11	
29	363	524	7297-7310	154-167	12	
30	364	525	7311-7324	168-181	13	
31	365	526	7325-7338	182-195	14	

JANUARY 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	527	7339-7332	195-209	15	29th
2	2	528	7353-7366	210-223	16	
3	3	529	7367-7380	224-237	17	
4	4	530	7381-7394	238-251	18	
5	5	531	7395-7408	1-14	1	
6	6	532	7409-7422	15-28	2	
7	7	533	7423-7436	29-42	3	
8	8	534	7437-7450	43-56	4	
9	9	535	7451-7464	57-70	5	
10	10	536	7465-7478	71-84	6	
11	11	537	7479-7492	85-98	7	
12	12	538	7493-7505	99-111	8	
13	13	539	7506-7519	112-125	9	30th
14	14	540	7520-7533	126-139	10	
15	15	541	7534-7547	140-153	11	
16	16	542	7458-7561	154-167	12	
17	17	543	7562-7575	168-181	13	
18	18	544	7576-7589	182-195	14	
19	19	545	7590-1603	196-209	15	
20	20	546	7604-7617	210-223	16	
21	21	547	7618-7631	224-237	17	
22	22	548	7632-7645	238-251	18	
23	23	549	7646-7659	1-14	1	31st
24	24	550	7660-7673	15-28	2	
25	25	551	7674-7687	29-42	3	
26	26	552	7688-7701	43-56	4	
27	27	553	7702-7715	57-70	5	
28	28	554	7716-7729	71-84	6	
29	29	555	7730-7743	85-98	7	
30	30	556	7744-7756	99-111	8	
31	31	557	7757-7770	112-125	9	

FEBRUARY 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	558	7771-7784	126-139	10	31st
2	33	559	7785-7798	140-153	11	
3	34	560	7799-7812	154-167	12	
4	35	561	7813-7826	168-181	13	
5	36	562	7827-7840	182-195	14	
6	37	563	7841-7854	196-209	15	
7	38	564	7855-7868	210-223	16	
8	39	565	7869-7882	224-237	17	
9	40	566	7883-7896	238-251	18	
10	41	567	7897-7910	1-14	1	
11	42	568	7911-7924	15-28	2	
12	43	569	7925-7938	29-42	3	
13	44	570	7939-7952	43-56	4	
14	45	571	7953-7966	57-70	5	
15	46	572	7967-7980	71-84	6	
16	47	573	7981-7994	85-98	7	
17	48	574	7995-8007	99-111	8	
18	49	575	8008-8021	112-125	9	32nd
19	50	576	8022-8035	126-139	10	
20	51	577	8036-8049	140-153	11	
21	52	578	8050-8063	154-167	12	
22	53	579	8064-8077	168-181	13	
23	54	580	8078-8091	182-195	14	
24	55	581	8092-8105	196-209	15	
25	56	582	8106-8119	210-223	16	
26	57	583	8120-8133	224-237	17	
27	58	584	8134-8147	238-251	18	
28	59	585	8148-8161	1-14	1	33rd

MARCH 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	586	8162-8175	15-28	2	33rd
2	61	587	8176-8189	29-42	3	
3	62	588	8190-8203	43-56	4	
4	63	589	8204-8217	57-70	5	
5	64	590	8218-8231	71-84	6	
6	65	591	8232-8245	85-98	7	
7	66	592	8246-8258	99-111	8	
8	67	593	8259-8272	112-125	9	
9	68	594	8273-8286	126-139	10	
10	69	595	8287-8300	140-153	11	
11	70	596	8301-8314	154-167	12	
12	71	597	8315-8328	168-181	13	
13	72	598	8329-8342	182-195	14	
14	73	599	8343-8356	196-209	15	
15	74	600	8357-8370	210-223	16	
16	75	601	8371-8384	224-237	17	
17	76	602	8385-8398	238-251	18	
18	77	603	8399-8412	1-14	1	34th
19	78	604	8413-8426	15-28	2	
20	79	605	8427-8440	29-42	3	
21	80	606	8441-8454	43-56	4	
22	81	607	8455-8468	57-70	5	
23	82	608	8469-8482	71-84	6	
24	83	609	8483-8496	85-98	7	
25	84	610	8497-8509	99-111	8	
26	85	611	8510-8523	112-125	9	
27	86	612	8524-8537	126-139	10	
28	87	613	8538-8551	140-153	11	
29	88	614	8552-8565	154-167	12	
30	89	615	8566-8579	168-181	13	
31	90	616	8580-8593	182-195	14	

APRIL 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	617	8594-8607	196-209	15	34th
2	92	618	8608-8621	210-223	16	
3	93	619	8622-8635	224-237	17	
4	94	620	8636-8649	238-251	18	
5	95	621	8650-8663	1-14	1	
6	96	622	8664-8677	15-28	2	
7	97	623	8678-8691	29-42	3	
8	98	624	8692-8705	43-56	4	
9	99	625	8706-8719	57-70	5	
10	100	626	8720-8733	71-84	6	
11	101	627	8734-8747	85-98	7	
12	102	628	8748-8760	99-111	8	35th
13	103	629	8761-8774	112-125	9	
14	104	630	8775-8788	126-139	10	
15	105	631	8789-8802	140-153	11	
16	106	632	8803-8816	154-167	12	
17	107	633	8817-8830	168-181	13	
18	108	634	8831-8844	182-195	14	
19	109	635	8845-8858	196-209	15	
20	110	636	8859-8872	210-223	16	
21	111	637	8873-8886	224-237	17	
22	112	638	8887-8900	238-251	18	
23	113	639	8901-8914	1-14	1	36th
24	114	640	8915-8928	15-28	2	
25	115	641	8929-8942	29-42	3	
26	116	642	8943-8956	43-56	4	
27	117	643	8957-8970	57-70	5	
28	118	644	8971-8984	71-84	6	
29	119	645	8985-8998	85-98	7	
30	120	646	8999-9011	99-111	8	

MAY 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	647	9012-9025	112-125	9	36th
2	122	648	9026-9039	126-139	10	
3	123	649	9040-9053	140-153	11	
4	124	650	9054-9067	154-167	12	
5	125	651	9068-9081	168-181	13	
6	126	652	9082-9095	182-195	14	
7	127	653	9096-9109	196-209	15	
8	128	654	9110-9123	210-223	16	
9	129	655	9124-9137	224-237	17	
10	130	656	9138-9151	238-251	18	
11	131	657	9152-9165	1-14	1	
12	132	658	9166-9179	15-28	2	
13	133	659	9180-9193	29-42	3	
14	134	660	9194-9207	43-56	4	
15	135	661	9208-9221	57-70	5	
16	136	662	9222-9235	71-84	6	
17	137	663	9236-9249	85-98	7	
18	138	664	9250-9262	99-111	8	
19	139	665	9263-9276	112-125	9	37th
20	140	666	9277-9290	126-139	10	
21	141	667	9291-9304	140-153	11	
22	142	668	9305-9318	154-167	12	
23	143	669	9319-9332	168-181	13	
24	144	670	9333-9346	182-195	14	
25	145	671	9347-9360	196-209	15	
26	146	672	9361-9374	210-223	16	
27	147	673	9375-9388	224-237	17	
28	148	674	9389-9402	238-251	18	
29	149	675	9403-9416	1-14	1	38th
30	150	676	9417-9430	15-28	2	
31	151	677	9431-9444	29-42	3	

JUNE 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	678	9445-9458	43-56	4	38th
2	153	679	9459-9472	57-70	5	
3	154	680	9473-9486	71-84	6	
4	155	681	9487-9500	85-98	7	
5	156	682	9501-9513	99-111	8	
6	157	683	9514-9527	112-125	9	
7	158	684	9528-9541	126-139	10	
8	159	685	9542-9555	140-153	11	
9	160	686	9556-9569	154-167	12	
10	161	687	9570-9583	168-181	13	
11	162	688	9584-9597	182-195	14	
12	163	689	9598-9611	196-209	15	
13	164	690	9612-9625	210-223	16	
14	165	691	9626-9639	224-237	17	
15	166	692	9640-9653	238-251	18	
16	167	693	9654-9667	1-14	1	39th
17	168	694	9668-9681	15-28	2	
18	169	695	9682-9695	29-42	3	
19	170	696	9696-9709	43-56	4	
20	171	697	9710-9723	57-70	5	
21	172	698	9724-9737	71-84	6	
22	173	699	9738-9751	85-98	7	
23	174	700	9752-9764	99-111	8	
24	175	701	9765-9778	112-125	9	
25	176	702	9779-9792	126-139	10	
26	177	703	9793-9806	140-153	11	
27	178	704	9807-9820	154-167	12	
28	179	705	9821-9834	168-181	13	
29	180	706	9835-9848	182-195	14	
30	181	707	9849-9862	196-209	15	

JULY 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	708	9863-9876	210-223	16	39th
2	183	709	9877-9890	224-237	17	
3	184	710	9891-9904	238-251	18	
4	185	711	9905-9918	1-14	1	
5	186	712	9919-9932	15-28	2	
6	187	713	9933-9946	29-42	3	
7	188	714	9947-9960	43-56	4	
8	189	715	9961-9974	57-70	5	
9	190	716	9975-9988	71-84	6	
10	191	717	9989-10002	85-98	7	
11	192	718	10003-10015	99-111	8	
12	193	719	10016-10029	112-125	9	40th
13	194	720	10030-10043	126-139	10	
14	195	721	10044-10057	140-153	11	
15	196	722	10058-10071	154-167	12	
16	197	723	10072-10085	168-181	13	
17	198	724	10086-10099	182-195	14	
18	199	725	10100-10113	196-209	15	
19	200	726	10114-10127	210-223	16	
20	201	727	10128-10141	224-237	17	
21	202	728	10142-10155	238-251	18	
22	203	729	10156-10169	1-14	1	41st
23	204	730	10170-10183	15-28	2	
24	205	731	10184-10197	29-42	3	
25	206	732	10198-10211	43-56	4	
26	207	733	10212-10225	57-70	5	
27	208	734	10226-10239	71-84	6	
28	209	735	10240-10253	85-98	7	
29	210	736	10254-10266	99-111	8	
30	211	737	10267-10280	112-125	9	
31	212	738	10281-10294	126-139	10	

AUGUST 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	739	10295-10308	140-153	11	41st
2	214	740	10309-10322	154-167	12	
3	215	741	10323-10336	168-181	13	
4	216	742	10337-10350	182-195	14	
5	217	743	10351-10364	196-209	15	
6	218	744	10365-10378	210-223	16	
7	219	745	10379-10392	224-237	17	
8	220	746	10393-10406	238-251	18	